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NOTES FOR THE MONTH.

PUBLIC moneys to the extent of about £80,000 in respect of the current financial year have been voted by Parliament to the Ministry for the maintenance of agricultural research. It may not be out of place, therefore, to indicate briefly the policy adopted in administering grants under this head.

Agricultural Research.

The bulk of the money goes to the various Research Institutions established throughout the country, each of which concentrates attention on a particular group of subjects. Thus, questions relating to the feeding of farm animals, the breeding of new varieties of cereals and other farm crops, and the breeding of small animals such as rabbits and poultry, are dealt with at the Research Institutes attached to the School of Agriculture at the University of Cambridge. Fruit-growing problems receive attention at the Horticultural Research Station (the National Fruit and Cider Institute) attached to the University of Bristol, and, on a somewhat smaller scale, at the East Malling Fruit Experimental Station associated with Wye College, Kent. The diseases of farm animals form the subject of research at the Royal Veterinary College in London, as well as at the Ministry's Laboratory at Addlestone,

Surrey, while tape-worms and kindred enemies of domestic animals, both in this country and abroad, are studied at the Helminthological Institute attached to the University of Birmingham. The Rothamsted Experimental Station at Harpenden possesses extensive equipment for the detailed study of problems connected with the constitution and bacterial fauna of the soil, and the nutrition and diseases of plants. Questions connected with the economic side of farming, including, of course, agricultural costings, are dealt with at the Economics Research Institute associated with the University of Oxford. Problems of dairy husbandry and the production of milk occupy attention at the Dairy Research Institute at Reading. In addition, several lesser Stations are engaged on special groups of problems; for example, the University College of Wales, Aberystwyth, has recently established a Chair of Plant Breeding, and has started work promising to be of great importance in connection with the breeding of clovers, grasses and other forage crops. Experiments in connection with glasshouse crops are conducted at the Waltham Cross Experimental Station, while the habits, life history and diseases of the honey bee are studied by workers attached to the Universities of Oxford and Cambridge.

Provision is also made for the investigation of special problems which lie outside the scope of the Research Institutions. Such problems are bound to arise continually, and if a worker of the requisite qualifications is available, and suitable means for carrying on the research can be found, a grant is awarded to enable him to carry it to a successful conclusion.

The work of the Research Institutions is, in the main, unlimited in its application. The value of the discoveries is not confined to the immediate neighbourhood, nor even, generally speaking, to the country as a whole, but is appreciated throughout the world. There are, however, certain problems peculiar to a particular locality, and to meet the need arising in this connection the Ministry has had in operation for a number of years an Advisory Scheme, under which competent technical experts, known as Advisory Officers, are attached to certain of the Provincial Agricultural Colleges, for the purpose of dealing with the special technical agricultural problems arising in their area. It is also the duty of these men—as the word “advisory” implies—to act as advisory officers among the farmers in the locality on problems connected with

the subject on which they specialise. In practice, it is found that the most important subject on which farmers require expert advice (apart from questions which may be referred to the County Agricultural Organisers) is plant diseases, and it is hoped that Advisory Officers on this subject will ultimately be available in every area. The Advisory Officers in Plant Pathology, as men employed in this work are called, act as the Intelligence Officers of the Ministry in regard to the incidence of plant diseases in their respective provinces, and close co-operation is secured between them and the Ministry's own Technical Advisers on this subject.

Reference may be made to the career offered by agricultural research. Hitherto, it must be confessed, this has been largely a blind-alley occupation. The research worker, properly so-called, must pursue his calling independently of any economic end. Occasionally discoveries are made which bring the work, and the value of it, to the notice of the public, but as a general rule the researcher continues his labours with little hope of encouragement from outside, and is often depressed by finding that several years of patient investigation have been along a path that has ultimately proved to lead nowhere. Valuable and vital as the work is, it rarely comes into the light. The result has been that, hitherto, adequate recognition has too often been either absent or belated. The War, however, has brought home to us that a Nation aspiring to industrial prestige cannot afford to lose sight of that fundamental research which is the only solid basis of industrial progress, and must offer sufficiently attractive emoluments to research workers to build up an adequate service. That the Ministry is alive to this position is indicated by the largely increased grants available to research institutions. It cannot be said that, even now, the salaries granted to research staffs are a true indication of the value of their work to the State, but at any rate an honest endeavour has been made to improve the lamentably low emoluments and prospects which have hitherto obtained, and to afford a reasonable career to men who prove themselves qualified to undertake research.

As a means of recruiting the research service, the Ministry has resumed the Research Scholarship Scheme which was in operation before the War, and a certain number of scholarships will be offered each year to men who have shown capacity for advanced work in this direction.

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• THE Ministry was well represented at the Royal Agricultural Show at Darlington. The Pavilion occupied a prominent position, and from the opening hour

**Ministry's Pavilion
at the
Royal Agricultural
Show.**

visitors came in large numbers to see the various exhibits. The leaflets and *Journal* of the Ministry were displayed attractively, and copies of the speech delivered by the Minister at Harpenden little more than a week before the Show opened were available for free distribution. Photographs and charts afforded much information about agricultural machinery, land cultivation, agricultural education and dairying. There were models of the cottages that are being set up on the Ministry's settlements. There were exhibits showing the value of seed testing, the work of bees, the equipment of land workers, noxious seeds, harmful insects and plant diseases. Excellent maps showed the position of various research and experimental stations throughout the country, and some space was given to the publications of the Agricultural Wages Board.

Nothing could be more gratifying than the numbers of visitors attracted by the Ministry's Exhibit, and the interest shown therein. The crowds that thronged the Pavilion, however, gave the surest indication that in future it will be necessary to devote far more space to the display if the public is to derive full benefit from this means of instruction. If all the branches of the Ministry's work are to receive a thoroughly adequate setting so that inspection of exhibits on any individual stand may be easy and unhampered, all risk of overcrowding must be obviated. It might be said that the Pavilion space would have been quite adequate had a smaller range of subjects been dealt with, but that would be to reduce the efficiency of the undertaking and to do less than is sufficient to meet the proper needs of the occasion. The public interest is not at all likely to fall off, and it has undoubtedly been stimulated to a very great extent by the agricultural developments of the past few years and by the prominent position into which British agriculture has been forced by the War. There can be no doubt that the public interest only needs a proper opportunity to expand, and with that expansion the Ministry's representation at the Royal Show will require extension upon a generous scale in order that justice may be done to the ever-growing list of its projects for the welfare of agriculture.

The demand for the Ministry's publications at the Show was very satisfactory, no less than 45,000 leaflets being distributed free, while in addition a large number of publications were sold.

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Ministry of Agriculture Pavilion, Royal Agricultural Society's Show, Darlington.

DURING the winter of 1916-1917, when the Government decided that the greatest possible area of land must be brought

**Machinery
and Implements
for
Food Production.**

under cultivation, the Food Production Department was organised to carry out the policy. It soon became apparent that to overtake the work properly, farmers would require great assistance in the shape of machinery, horses and implements, as the farming machinery and implements available were insufficient, and the War had made a tremendous call on men and draught horses. The only alternative was to concentrate for the greater part on mechanical cultivation. Very few tractors were to be found in this country, and these were mostly experimental, but a start was made by hiring available machines, and by obtaining the loan of heavy caterpillar tractors from the Russian Government, until such time as large numbers of up-to-date tractors could be procured. In all, 666 machines were thus obtained. At the same time, arrangements were made to purchase sufficient machines to supply other Government Departments, and private owners who could make full use of them. In all, 5,180 tractors were used for the Department's Scheme, while other users were supplied with 5,628. Though the Food Production Department desired to foster the trade in this country, it was found that agricultural engineering firms were fully employed on munition work, and that this country could undertake the manufacture of only 645 tractors and a limited number of implements. This left no alternative but to turn to the United States of America for the bulk of the required equipment. Trials had already proved the need of a lighter machine, and accordingly 6,000 Fordson tractors, 2,600 Titan tractors, and other tractors of American make, were ordered. The wisdom of this policy has been proved by the demands made for these tractors, which are still in steady request. In all, three English and thirty imported types of tractors were tried by the Department. With a view to standardisation of spare parts, attention was concentrated on four makes, Clayton and Shuttleworth, Saunderson (English makes), and Fordson and Titan (U.S.A.). Certain discarded machines had proved useful, but the types named had preponderating merits. It is noteworthy, as confirmation of the Department's choice, that very few of the discarded types were represented in last year's trials at Lincoln.

The supply of implements was difficult owing to the many different soils and to local prejudice. For use in connection

with the Fordson tractor, the Oliver Plow Company designed a special plough, giving every satisfaction when the width of furrow and form of breast had been adapted to English conditions. Twenty-five other types of plough were tried with tractors other than Fordson's. Of the English makes, Ransomes', Howard's and Saunderson's did very well. Of imported implements used by the Department, Cockshutt's and Hamilton's found most favour. Before the War the few English tractor ploughs in use were of the old rigid type, and the British manufacturer did not quickly realise that the future lay with the self-lift plough. Other implements used with tractors were cultivators, disc harrows, furrow pressers, trailer boxes and small vans. Useful auxiliaries of the supply were lubricants and spare parts.

On heavier land the steam plough was used. Of these there were in England about 500 sets, not employed to the greatest advantage. Steam ploughing was quickly organised so that the sets should be fully employed, especially for breaking up grass land. As there was ample scope for other sets, a contract for 65 steam ploughs was placed, and these were sold to the contractors best able to secure the full employment of the machines. For small fields and hilly land, and to assist small farmers, the Department secured 11,694 horse ploughs, with harness and implements.

Having assured greater corn production, the Department then made provision for threshing. It was found that the country was not only short of threshing machinery, but that the existing machinery was badly distributed. Four hundred and thirty-six threshing machines were therefore ordered, and the distribution was made more suitable to the prevalent conditions. There was work for still more machinery, but it was impossible to secure the machinery from firms already taxed to the utmost with other work. In harvesting plant there was also a great shortage, and provision had to be made for 6,500 binders, 4,218 of which were used for County Executive Committees and the remainder released for sale. All sales were subject to the approval of the Department, whereby it was ensured that the machines should go to the counties that stood most in need of them.

The following figures show the machinery, implements and accessories provided by the Department :—

<i>Tractor Scheme.</i>	<i>Steam Tackle.</i>
10,808 Tractors.	65 Complete Sets.
10,755 Ploughs.	436 Threshing Machines.
1,677 Cultivators.	

<i>Tractor Scheme.</i>		<i>Horse Scheme.</i>	
1,758	Disc Harrows.	11,694	Horses with Harness.
1,078	Trailer Boxes.	6,500	Binders.
249	Tool Boxes.	10,240	Ploughs.
106	Land Pressers.	250	Potato Diggers.
960	Ford Box Vans.	367	Mowers and Reapers.
131	Motor Cars.	3,684	Rollers.
109	" Cycles.	2,590	Cultivators.
6,318,532	gal. Paraffin.	2,239	Drills.
1,011,868	" Petrol.	576	Furrow Pressers.
773,880	" Lubricating Oil.	5,500	Harrows.
264,544	lb. Grease.	1,658	Carts.
		1,604	Wagons and Lorries.
		114	Spraying Machines.

Shortly after the Armistice it was considered desirable that the Government operations should cease, and that the whole of the acquired plant in their hands should be disposed of, but in such a way as not to upset any arrangements already entered into by County Executive Committees, and also to give farmers who knew the machinery and accessories an opportunity of acquiring them. The majority of counties decided to commence disposal early in 1919, but a few counties were so committed that they were compelled to continue up to the end of the 1919 harvest. All work definitely ceased, however, on 30th September last, and the whole of the stock has now been disposed of. Over 1,000 sales have been held in market towns convenient to the place where the materials had been used, and in most cases farmers were the purchasers.

Apart from the provision of the above plant for the purpose of prosecuting their scheme, the Department undoubtedly did a very great service to farmers, as for a considerable period of the War little or nothing had been done by manufacturers in this country—who were engaged on other work—to replace wastage and to supply the need for new implements, and but for those made available for farmers by the Department, a very difficult situation would have arisen. Further, the Department's Tractor Scheme, as is generally recognised, has hastened mechanical cultivation by many years. Before the Department embarked on their Scheme it is doubtful whether there were 500 tractors in this country, whereas it is fairly safe to say that there are now 20,000, and that the character of implement yards all over the country has been entirely transformed. The sum realised from the sale of the machinery, horses and implements above referred to shows that only a depreciation of 30 per cent. occurred on the purchase amount, which is very gratifying when it is remembered

that the materials received the roughest treatment in breaking up hard ground and rough handling by makeshift drivers and mechanics.

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FOR some time past the Ministry has given attention to that very interesting auxiliary to horse breeding, the mountain or **The Mountain Pony**: moorland pony. Every year pony stallions are brought to shows for judging and **Its Value** to Agriculture. veterinary inspection, and the best and most typical specimens of the breeds which it is desired to perpetuate are awarded premiums. These premiums, however, are awarded only in those districts in which Regulations under the Commons Act, 1908, have been made and are enforced, or where, as in the case of the New Forest, similar regulations are in force to prevent undesirable stallions from roaming at large. Hardy ponies run wild on the mountains, moorlands and commons of Wales, on Dartmoor, Exmoor and in the New Forest, where they have roamed for many generations. Their excellent blood can be traced in the finest varieties of the hunter, the racehorse, the hackney, and the polo pony, while the mountain pony itself is often the best draught animal that the small holder can desire.

Strictly defined, a mountain or moorland pony is one whose ancestors have lived half wild on mountain, moorland and common for at least three generations. All breeds have probably a common origin—the ancient British pony—but they have now become so differentiated as to constitute separate breeds. The differentiation arises from such causes as the selection for the particular kind of work they have been required to perform; the attempts that have been made from time to time to improve the breed; too close in-breeding; and breeding from immature, unsound or aged stock. The two causes last mentioned have tended to bring about deterioration, and on this matter it has been said that the history of any breed of ponies is the story of man's neglect of them and his interference with their freedom. The better policy now in force promises a steady improvement in a stock too valuable to be left uncared for. It is sufficient testimony to the vigour, vitality and native excellence of the pony that he is still found in so perfect a state upon his native pastures. He can live where sheep and cattle only die; he has every instinct sharpened by self-preservation, every limb tested by exertion, and he fights his battle unaided, even in the restricted pastures of wire-enclosed mountain spaces. These ponies, bred in the

open, are the natural reservoirs from which our national breeds of light horses are derived, and from which these breeds re-invigorate temperament, courage and resource. The value of the mountain and moorland ponies as a factor in the breeding of English light horses depends upon the purely natural conditions of their life in the forest, on the hills and on moors. Amid adverse conditions, they possess resource, endurance and courage, as well as the hardiness of constitution and soundness of stamina that make the infusion of their blood into other breeds so powerful for good. Their ancestral strain can be traced in the English racehorse, together with the blood derived from the Great Horse of England and from the Barbs of Africa, Arabia, Syria and Turkey. In the eighteenth century, ponies were largely used for racing, and gave ample evidence of blood and courage. Towards the end of that century they had received a large mixture of Eastern blood, and were famous as racehorses proper. These ponies came chiefly from the Fell districts of Westmorland, Cumberland, Wales, Exmoor and the New Forest. Proof of their prowess on the course exists in the General Stud Book, where records, a hundred and thirty years' old, confirm the mixed origin of the English racehorse, which was not derived, as is generally supposed, from pure Eastern strain. The fact is, rather, that the Eastern blood gained greatly by its admixture with pony blood. The first reference to the influence of native ponies on the racehorse dates from the reign of James I., and Gervase Markham makes special note of the mental qualities of a racing pony of native descent. He attributes these virtues to the wild, natural life led by the pony's ancestors. Breeders are aware that the thoroughbred, now an established race, can receive no further benefit from the Arab or the pony. In the cases of the hunter, the polo pony, and the hackney, however, the opportunity of improvement still exists. For these, their breeders still seek finer action and greater endurance, which, fortunately, are obtainable by a recurrence to the original pony ancestor of the modern thoroughbred. Infusion of pony blood from mountain and moorland reservoirs is required to re-invigorate our light horses.

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DECONTROL of home-produced meat and live stock became effective on 4th July, when the guaranteed price to the British farmer—the basic fact of live stock control—ceased. The guaranteed price had been in operation since 27th December, 1917. The original guarantee was to have expired at the end of

**Decontrol of Meat
and Live Stock.**

September, 1919; but the unsettled state of affairs at that time, and the failure of the general expectation that equipoise would be recovered, both in regard to supplies and prices, although nearly a year had elapsed since the signing of the Armistice, caused the Cabinet to decide on the continuance of the farmer's guarantee, in an amended form, until 4th July this year. In spite of the drawbacks and difficulties attendant on the existence of this guarantee, it succeeded in the object which the Food Controller had in view, namely, to ensure a regular supply of home-produced meat. That was its success, particularly in the days of war when the civilian population of Great Britain was mainly dependent on home supplies.

The position on and from 4th July is that the Statutory Rules and Orders in connection with the meat industry, issued by the Food Controller and in force up to 3rd July, have been revoked, with one exception, namely the Bacon (Prohibition of Export) Order, 1918, which will continue in force so far as it relates to bacon, ham and lard. The Orders which have disappeared are as follow:—Slaughterhouses (Licensing); Live Stock (Sales); Live Stock (Restriction on Shipment to Channel Islands); Meat (Dealers Retriktion); Meat (Control); Meat (Sales); Meat (Licensing of Wholesale Dealers); London Central Markets; Meat (Licensing of Export) (Ireland); Meat (Maximum Prices); Edible Offals (Maximum Prices); Meat Retail Prices (England and Wales); Meat Retail Prices (Scotland); Imported Meat (Requisition).

By these revocations meat control has been entirely removed; but it is proposed to continue, for the present, three measures of control, viz. :—

- (a) The licensing of slaughterhouses.
- (b) The registration of retail meat dealers.
- (c) The fixing of maximum wholesale and retail prices of chilled and frozen beef and lamb, and maximum wholesale prices of chilled and frozen mutton.

The licensing of slaughterhouses is being carried out under a new Slaughterhouses (Licensing) Order. The Food Controller has issued a circular to every slaughterhouse keeper, explaining that licences issued under the former Order will continue in force and will be deemed to have been issued under the new Order. Any application for a new licence will, in future, have to be made to the Divisional Food Commissioner for the Area in which the premises are situated. The Order gives the Food Controller power to require the making of returns; and in order that information may be available concerning the state

of supplies of home-killed meat, every slaughterhouse keeper will be required to send to the Ministry of Food every four weeks a return of animals slaughtered during that period.

It should be noted particularly that no charges incurred after the date of decontrol of live stock are recoverable from the Central Live Stock Fund. All claims in respect of charges payable by the Central Live Stock Fund, incurred prior to July 4th, should be rendered to the local auctioneer, or other agent of the Central Live Stock Fund to whom such claims are normally forwarded, or else sent direct to the Secretary, Central Live Stock Fund, 100, Cromwell Road, London, S.W. 7, not later than Saturday, 31st July, 1920. No claims received after that date will be entertained by the Fund.

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AMONG the demonstrations arranged this year by the Ministry through the medium of the Horticultural Sub-Committees,

Potato Demonstration Plots, 1920. those framed in the interests of potato cultivation are receiving prominent attention. The important part now played by

potato crops on both farms and allotments makes it very desirable that such trials should be conducted widely throughout the country.

For several years past, the Ministry's Potato Trials at Ormskirk have been supplemented by trials in different parts of the country, in order to compare the cropping qualities of the more important immune varieties, and to ascertain, also, the varieties most suitable to particular soils and districts. The results, which should be of very great use to potato growers, have clearly demonstrated the value of such trials, and point to the need for the work to be continued in subsequent years in every county, and on the many classes of soils within each county. It is hoped that as a result of this year's trials more precise information on these points may be available.

It was realised that the most valuable results could only be obtained by working all the plots uniformly. A memorandum was therefore circulated by the Ministry to all Horticultural Sub-Committees and to County Agricultural Organisers, setting out definitely the lines on which the trials should be conducted. The Ministry's Scheme provided for (a) farm trials, and (b) allotment trials. The trials themselves were divided into two main sections. The object of the first section was to demonstrate the cropping powers of the well-known immune varieties, and of the second to compare the earliness of cropping qualities of certain early varieties. In the Ministry's memorandum

were set out in detail the varieties of potatoes to be planted and the quantity of "seed" of each variety, the method of preparation of the land, the manures to be used and particulars as to planting.

For section one trials, the following varieties were recommended :—

1st Earlies.—Snowdrop and Dargill Early.

2nd Earlies.—Great Scot and Arran Comrade.

Main Crops.—Majestic, Kerr's Pink, Golden Wonder, Tinwald Perfection and Abundance.

For section two, the varieties selected were :—

Duke of York, Ninetyfold and Epicure (for lands only to which the provisions of the Wart Disease of Potatoes Order of 1919 do not apply), Dargill Early, Arran Rose, King George, Nithsdale, Arran Comrade and Snowdrop.

It is important that all the "seed" planted in such trial plots should be obtained from the same source, as comparison of results, both local and general, would be of little value if the "seed" used had been raised in widely different parts of the country. The Ministry, therefore, arranged for the supply of the necessary "seed" potatoes of the varieties mentioned. It was at first contemplated that the Ministry should purchase the "seed" in bulk and consign it to the various counties as ordered, but in view of the lateness of the season and the practical difficulties involved, it was decided that the "seed" should be purchased direct by Committees from certain specified dealers, with whom the Ministry made arrangements for supplying reliable stocks of the varieties recommended.

It was found difficult to obtain complete supplies, and, consequently, Dobbies Favourite was substituted for Abundance, a variety which it resembles closely. The supply of Epicure was early exhausted.

As a general rule the Horticultural Sub-Committees have entered whole-heartedly into the Ministry's Scheme, and are following carefully the suggestions put forward for the success of the trials, both from a local and national point of view. In some counties, however, no potato trials are being carried out under the Ministry's Scheme, while in others it has not been closely followed. The Ministry's Inspectors are in touch with Horticultural Sub-Committees, County Horticultural Superintendents and Agricultural Organisers, and advice and assistance have been given where necessary.

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THE Ministry has just issued the third edition of the Handbook of British Breeds of Live Stock. This Handbook was

**Handbook of
British Breeds of
Live Stock.**

originally prepared for the Brussels and Buenos Aires International Exhibitions of 1910, with the special object of encouraging the export of British live stock, and a second and revised edition was issued in 1913. The third edition, now issued, contains further and extensive revision, and it is hoped that it will prove of service to all who are interested in live stock, whether for exportation or otherwise.

The object of this publication is to give an account of the principal characteristics of all the British breeds of horses, cattle, sheep and pigs, with a brief history of their origin, and of some of the principal animals which have formed the foundation stock of the pedigree animals of the present day. It contains particulars of the different breeds of heavy draught horses, light horses and ponies; beef, dual purpose and dairy cattle; longwooled, down, mountain, and other breeds of sheep; and pigs.

A statement of the more important shows and places at which the animals of each breed can be bought, together with an indication of the average prices, is given for the information of prospective purchasers. For further particulars and for the names of individual breeders, readers are referred to the secretaries of the breed societies, whose names and addresses are given.

The Handbook contains 136 pages of letterpress, and is illustrated by some 90 photographs of animals of the different breeds. Copies may be obtained from the offices of the Ministry, 3, St. James's Square, London, S.W. 1, price 3s. 6d. net., bound in paper boards.

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It appears from reports which have been received from Officers of the Ministry and from owners of licensed stallions,

**Production of
Licences
for Stallions.**

that in some instances unlicensed stallions are being travelled for service, and in other cases leaders of licensed stallions have not been able to produce the licences when asked to do so. In this connection special attention is drawn to Section 3, Sub-section 3 (b) of the Horse Breeding Act, 1918, under which provision is made to enable police officers to require the production of licences by the persons in charge of stallions which are being travelled for service. Steps have been taken by the Ministry for instructions to be issued

to police officers to exercise their powers and require the production of licences of all stallions which they meet on the road or at markets, fairs, and similar meeting places.

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At the Ministry's Exhibit at some of the chief agricultural shows this year are included home handicrafts, the goods

**Home-Handicraft
Exhibits.**

exhibited being made by cottagers and other country people. It has been the Ministry's endeavour to suggest means whereby the women in rural districts should be enabled to engage in occupations that can be carried out at home. It was also desirable that these handicrafts should be taken up by youths and men during the winter months, on days when land work might be impossible. Preliminary experiments proved very encouraging, but they showed clearly the need of organisation. Country people are in no way lacking in the enterprise or imagination necessary for these subsidiary occupations, but in order to make them successful skilled instruction, guidance and organisation are necessary. The Ministry has given attention to occupations other than handicrafts, such as the manufacture of sugar from sugar beet, but these industries are suitable only in districts where factories exist. The case is different with the lighter forms of home-work, as, for instance, basket-making, cloth-making, toy-making, spinning and weaving, the manufacture of small leather goods, and wood-work. Experiments have already shown promising results, and examples of these industries are included in the Ministry's exhibit. It is not intended to set up these village industries as a rival to land work, but rather as a supplement to it, and to give the rural population an opportunity of engaging in interesting and helpful pursuits which may be carried on during their spare time.

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THE practice of baling hay on the field has been known in Lancashire for some years, and the experience of last summer

**Baling Hay on the
Field.**

suggests that it is likely to be considerably extended. The baler, operated either by tractor or by steam engine, is stationed in the field, and the hay is baled direct from the windrow or cock. The bales are about 36 in. by 20 in. by 16 in., and weigh from 130 to 160 lb. The hay, at the time of baling, should be in the same condition as if it were intended to stack it in the ordinary way. Some care is necessary in storing bales. Whether stored in a stack on the spot or in a Dutch barn,

they should be stood on their edge and packed as closely as possible, as otherwise there is some risk of mould. Crevices between bales on the outside of the stack should, it is suggested, be filled up to prevent the entrance of air and light. If the hay is properly and tightly baled, however, the risk of mould is considerably reduced. ■

By this system both labour and storage space are saved, and waste in handling is reduced. The hay is immediately available for transport or for use, and can be easily trucked and re-stacked.

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In view of the value of the lapwing (green plover, or peewit) to agriculture, the Ministry* is desirous that the protection afforded to this bird throughout England and Wales should be extended. The lapwing does no damage to crops, and is exceedingly useful to the farmer. It devours snails, slugs, wireworms, beetles, and the larvae of insects such as crane-fly, turnip moth, and yellow under-wing, which prey upon the roots of grass, turnips, and cereals, and it is also of benefit to sheep-owners, in that it feeds on the water-snail that harbours the immature form of liver-fluke, the cause of the liver rot in sheep.

Quite apart from the limitation of numbers by direct destruction of birds, the natural increase of the lapwing is hindered by reason of the fact that the eggs are much sought after as a table delicacy.

The present position is that the killing or taking of the lapwing is absolutely prohibited by Statute as between the 1st March and the 1st August, and on the application of the Councils of the counties and county boroughs concerned, the Home Secretary has made Orders in respect of 39 counties and 36 county boroughs according additional protection to the eggs or the bird or to both.

The Departmental Committee on the Protection of Wild Birds in its report* issued last year recommended that the protection of the lapwing should be standardised and put beyond doubt by the Statute. The clause suggested in the report for this to be carried into effect by legislative action was:—

"Lapwing (Plover).—Eggs and nests to be absolutely protected, except that owners, or persons authorised by them in writing, should be allowed to take the eggs on their own land up to the 15th of April."

* See this *Journal*, November, 1919, p. 832.

It is the view of the Ministry that the minimum protection which should be accorded to the eggs of this bird is that suggested by the Committee in the clause above quoted.

A copy of Leaflet No. 44 on the Lapwing may be obtained post free on application to the Ministry.

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THE attention of the Ministry has again been called to the objectionable practice of "udder stocking," which is still so widely adopted by dealers and farmers

"Udder Stocking." when offering milch cows for sale. The Ministry, therefore, desires to make known

to all concerned that, from every point of view, this practice deserves the severest condemnation.

"Udder stocking" is brought about by leaving the cow unmilked for a longer period than that to which she is accustomed. The udder in consequence becomes distended with milk, and so presents an appearance indicative of a milking capacity greater than the cow really possesses.

The purpose of "udder stocking" is, of course, to deceive a prospective purchaser into paying a higher price for the cow than he might otherwise offer, and on these grounds alone is indefensible. Two further considerations, however, need to be borne in mind. In the first place, it is an offence against the law to inflict unnecessary suffering on cows in this manner, and offenders are liable to punishment on conviction. Secondly, "stocking" may seriously reduce the yield of milk from the cow, not only during the period of lactation in which the cow is made to suffer, but after all subsequent calvings. In view of the high price of feeding stuffs, and of all other costs of production, it is especially important at the present moment that farmers as a body should do nothing to impair the productivity of the animal to which they look for a return on their outlay.

The Ministry hopes, therefore, that the practice of "udder stocking" will be severely condemned by all engaged in agriculture.

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At a recent meeting of the Royal Sanitary Institute at St. Helens, Captain J. Woolley submitted several interesting points

Rat Destruction:

**The Need for
concentrated Effort.**

in reference to rat destruction. His account was based on observations made during the rat destruction campaign in Lancashire. In the course of these operations it was found that rat destruction by areas proves far more successful than fragmentary treatment by poisoning in scattered districts.

There can be no doubt that the rat has some method of communicating to its fellows the warning of danger when something unusual and hostile to itself is afoot, and it is, therefore, essential that all the poisoned baits should be laid on the same day by a screen of men advancing in one direction. The Lancashire campaign has shown extract of squills and barium carbonate to be the most successful poisons used in the county. These chemicals were mixed with fresh bread and sweetened tinned milk. Another most interesting fact disclosed was that during ratting operations, when the poison had been laid, doe rats were found dead on nests containing dead young. Approximately 85 per cent. of the dead found proved to be doe rats. The reason for this appears to be that the female is greedy for the milk-bait on account of aid the milk affords to suckling.

Captain Woolley observed further that before the beginning of the rat migratory season extermination work should be undertaken on as extensive a scale as possible. This should be done before the rats begin their movement to new quarters in the open fields, where food is more plentiful and accessible. After the migration has started it is far more difficult to cope with the pest. The Lancashire authorities found that poison had been effective, and that in suitable places ferreting and trapping also had their uses. The most effective trap had proved to be a wire cage, Brailsford pattern, baited with a raw tomato. No explanation could be offered why this bait should be so readily taken. It was also found that traps of a similar kind usually baited with toasted cheese, fish, bread, oatmeal, meat and tomato, had invariably given the best results when tomato was employed.

The suggestion was made that the Boy Scouts should be interested in the question of rat destruction. If the members of that active body were given lectures on the habits of the rat and its terrible destructiveness, not only would the subject provide a very interesting natural history lesson, but the lectures would also help the scouts to assist the community. Boy Scout corps could in particular be organised for the purpose of concentrated war on the rats all over the country on specified dates as, for example, once weekly.

The discussion of preventive methods, more especially with regard to buildings, called forth the suggestion that premises should be proofed with cement, broken glass and tar applied to the old rat-runs as soon as they were discovered to be "dulled" during the warm weather. It is well that this should be done while the rats are out in the fields, so that at the end

of the summer, when the migratory season recurs and the vermin endeavour to return to their winter homes, they can be caught in large numbers. This can be assured by the laying of poison baits in close proximity to the old runs, and also by the use of bird-lime trays.

Grain stacks, a great harbourage of rats, can be protected by sheets of corrugated iron sunk 3 ft. below the ground all round the stack, together with a fine mesh wire surface fencing 3 ft. high. It has been definitely proved that the rat never burrows more than 2 ft. 6 in. below the ground, so that even where stacks cannot be built upon staddles this method would ensure protection for the grain. Before threshing begins, all standing stacks should be surrounded by wire fencing to prevent the escape of any rats. It was recommended that all threshing-machine owners should be asked to carry wire-netting for this purpose as a part of their ordinary equipment. The same method was proposed for use in ship-breaking yards, whence spread great numbers of rats which enter our ports on board old vessels.

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At the meeting of the Norfolk Executive Committee on 12th June, the opinion was freely expressed that the officials

Foot-and-Mouth Disease in Norfolk.

of the Ministry had been to blame in that they had not prevented movements of certain sheep, which have led to the

disastrous series of outbreaks of foot-and-mouth disease over a wide area of the county. It is natural enough for men who find their businesses threatened by an outbreak of this magnitude to desire to blame somebody, but these opinions, to which so much publicity has been given, would probably have never been uttered had the whole of the facts been before the meeting. Briefly, the circumstances as at present ascertainable are as follows :—

On 12th April, an outbreak of foot-and-mouth disease was diagnosed by the Ministry's officials at Stanninghall, Frettenham, about 6 miles north of Norwich. Unfortunately, the disease had been on the farm for some days before it was reported, but the usual procedure was followed and a considerable area of the district was closed to movements of stock. This outbreak was successfully confined to the vicinity of the infected farm.

On 10th April, two days before the disease was detected at Stanninghall, the owner of some sheep grazing on the adjoining farm had moved them to Bowthorpe, about 4 miles

west of Norwich. No information of this movement reached the officials of the Ministry, though they visited this adjoining farm in the ordinary course of their inspection. This latter farm remained free from disease and has never been under suspicion. The Bowthorpe farm came within the area within which movement was restricted because of the outbreak at Stanninghall. Restrictions were, however, removed from this area on 3rd May, when, owing to the absence of further reports or outbreaks, it was considered that this step could be safely taken.

On 1st June, one of the Ministry's Veterinary Inspectors, on receipt of a report by a Veterinary Inspector to the Local Authority of the County of Norfolk, visited the Bowthorpe farm, and there found that 5 cattle and 8 sheep were affected with foot-and-mouth-disease. He then heard for the first time of the movement of sheep from Stanninghall, and at the same time his inquiry elicited the fact that 570 sheep had been removed about 9th May by road from Bowthorpe to Emneth, a distance of about 50 miles. Their track was immediately followed, and inquiries made on either side of the road they had taken. Unfortunately the mischief had been done, and outbreaks were discovered at various places along the route. In these circumstances heavy slaughtering was inevitable, and the necessity of slaughter was increased owing to the fact that other owners on the route had also by this time moved sheep over the infected track. It is now hoped that the full extent of the infection has been traced and that the outbreak is well in hand.

Clearly the officials of the Ministry had no reason to suspect the farm at Bowthorpe from which the disease was distributed, inasmuch as it is several miles away from the earlier outbreak at Stanninghall and there was apparently nothing to connect the two.

SPEECH BY THE MINISTER OF AGRICULTURE AT THE ROTHAMSTED EXPERIMENTAL STATION.

THE following is the text of a speech by The Lord Lee of Fareham, Minister of Agriculture and Fisheries, at the Rothamsted Experimental Station, on Thursday, 17th June, 1920 :—

LORD LEE OF FAREHAM: Mr. Chairman, my Lord, Ladies and Gentlemen, may I in the first place say how glad I am to see such a remarkable rally of farmers. I could hardly believe it when I was told just now that you all come from Hertfordshire. It seems to me that farmers are really getting interested in agriculture, and what is perhaps more important, the country and the Government are getting very interested in farmers! (Hear, hear.) No doubt you will say it is about time.

The Agriculture Bill.—I hope that Dr. Russell and his staff will forgive me if on this occasion, when perhaps I might be expected to speak on the subject of agricultural research, I think it wiser to leave that for some future time and to deal to-day mainly with the subject which I am sure must be uppermost in your minds; that is, the agricultural policy of the Government as indicated in the Bill which is now before Parliament. I think it is necessary that I should speak on that subject because there appear to be so many perfectly honest, but at the same time exasperating, misunderstandings with regard not merely to the aims and objects of the Bill, but with regard to its actual provisions. I have noticed with regard to agriculture, as with other subjects, that the most severe critics are apt to make a point of not reading a measure or a speech before they proceed to criticise it. It is perfectly clear that a great many of the criticisms which have been directed against this Bill come from people who really have not taken the trouble to understand what the Bill is and what it proposes to do. That is very notably the case with regard to guaranteed minimum prices. Let me say in passing that personally I am very well satisfied with the reception which the Bill has had in the country as a whole and amongst farmers. I am aware there has been no what I might call extravagant enthusiasm for it amongst farmers, but I think that is a clear indication that it is not handing out special favours to one section of the industry or another, and that it is a fair attempt

to frame a moderate balanced policy which will do justice to all concerned in the industry. Certainly the praise which has been bestowed on the Bill, to the effect that at any rate it is an honest effort to help the industry and to keep the pledges which the Government has made, is the highest tribute I would possibly ask for it from any agricultural audience.

The Scope of the Bill.—As Lord Hampden said just now, we are not considering only the farmer, the labourer and the landowner, we are considering also the far greater number of consumers in this country. He was quite right in saying that this Bill is really, in the long run, framed more in the interests of the whole population—the consuming population—than it is in the interests merely of agriculturists. There is, however, one perfectly sound criticism directed against the Bill, and that is, that it has been too long delayed; that it ought to have been introduced before, to have had the full effect which is desirable. Well, you cannot always deal with these extremely complicated, intricate and controversial questions as quickly as you would like, and sometimes the longest way round is the shortest way home. It was certainly worth while—at least I think it was worth while—to try and get a substantial amount of common agreement with regard to this policy before putting it into a Bill and launching it upon the parliamentary seas. I think our judgment in that matter has been justified by the fact that there is a growing measure of support for the Bill, sometimes coming from quite unexpected quarters. I am delighted to see that amongst the supporters of the Bill is now numbered Mr. Horatio Bottomley, a very useful ally, who recognises that it is a Bill which is for the interests of the nation as a whole. Then I was particularly gratified to read in last Sunday's papers that very wise, balanced and judicial support of the Government's policy coming from that great agriculturist, my predecessor, Lord Ernle. He points out most convincingly, not only with regard merely to agriculture, but with regard to national health and financial stability, that the interests of the nation are bound up in a policy of greater home production. He finished up by saying what I am sure will stick: "It does not do to gamble with the food of the people;" and that is what we have been doing up till now in our national agricultural policy. We have been gambling all the time upon the chance—not the certainty—that we should be able to get everything that we wanted from overseas. The idea

was that it did not matter where it came from so long as it was cheap, even if it ruined the British farmer and the whole of the agricultural industry and drove down the wages of the agricultural labourer to starvation point. Thank goodness the nation has seen the light as a result of the War, and whilst they may not have learnt yet all there is to learn, and though it may not have sunk in as deeply as it ought to have sunk in, at any rate I think we are on the right road, as shown by the reception of this Bill. Its principal object, of course, is to encourage arable farming in the national interest, but at the same time it recognises that you cannot encourage arable farming in times of peace, and you cannot get increased production at home, unless you make it *worth the while* of the producer.

Security for the Producer.—The policy of the Bill is to give the producer—the agriculturist—a greater sense of security which will encourage him to greater enterprise, and to do this not by guaranteeing him profits at the expense of the taxpayer, but by giving him a reasonable and fair chance of a profit, and at the same time guaranteeing him against disastrous loss if he engages in a form of farming which means more risks for him and which has often in the past brought him nearly to ruin. We are not seeking to secure for the farmer profits in his business, but we are seeking to expose him to less risks. The Bill in this respect gives what I venture to say has been asked for, not merely by farmers but by nearly all agricultural reformers who have investigated this great question for the last generation. Though the Government measure may not go as far as some would wish, at any rate we claim that it goes much further than anything else which has been offered by any Government, and I do most earnestly ask the farmers of this country to respond, and not to respond only in a small way, but with generosity and patriotism, to the call which now comes to them.

The Minimum Price of Wheat.—I spoke just now about the misunderstandings of what the actual proposals of the Bill are with regard to guaranteed prices. May I add that if after what I am going to say it is still not clear to any farmers in this room, will they ask me questions about it afterwards? I am quite prepared to answer any questions with regard to the Bill to the best of my ability. I do not want anyone to say afterwards that they do not understand what the position is or what the Government is offering. In the first place may I say, with regard to one criticism which has been

frequently indulged in, that the farmer to-day is not being asked to grow wheat at 68s. a quarter. I have read several such criticisms in the last few days: "What is the use of the Government asking us to grow wheat to-day at 68s. a quarter?" The answer is that we are not asking the farmer to do anything of the kind. The 68s. was the figure calculated as a starting point in 1919 by the Royal Commission and referred to conditions which are now past. The minimum price which the farmer will receive in any event for his wheat will be calculated on a sliding scale starting from the 68s. It will either go up if the cost of production increases, or go down if the cost of production falls below the point at which it was when that 68s. was calculated in 1919. You may ask me: "What is the equivalent to that 68s. to-day?" As you know from the Bill, the guarantees do not come into force till next year; but we have made calculations as to what would be the comparative figure to-day, if the guarantees were in force, and we are of opinion—although I must not anticipate the work of the Commissioners—that the equivalent figure to-day would be between 80s. and 85s. Next year it will probably be higher. That, if the guarantees were in operation this year, would be the *minimum* price which the farmer could possibly receive. But above that we give him in connection with these guarantees, for the crop of next year, the equivalent of the free play of the market. (Hear, hear.) At whatever price imported wheat comes into this country the farmer will get the equivalent of that price for his wheat harvested in 1921, instead of being tied down, as he has been recently, to a controlled maximum. What the average world price will be for wheat harvested next year I cannot foretell. The Food Controller has suggested that it may go as high as 140s. In the interests of the community I hope it will not, but it seems almost certain that the price will be well above the average of 100s. at which it stands to-day. Surely then, if the farmer is protected on the one hand against serious loss, if he grows wheat, by a minimum price which to-day could not be less than 80s., and, on the other hand, he is to have the chance of making his profit up to the average world's price, then I venture to say he is being given not merely what he is entitled to, but everything that he has asked for through any of his responsible representatives. That being so, I have no doubt myself, and I am glad to learn in discussing it with leaders of agricultural opinion that they have no doubt, that this inducement will prove sufficient to bring about

a largely increased sowing of wheat this autumn, not merely from motives of patriotism, but simply because it will be well worth the while of the farmer to do it; and after all that is the best inducement.

The Acreage Basis of the Guarantee.—Then, perhaps, I shall be asked: "Why is it that this guaranteed minimum price is based upon the acreage grown rather than upon the amount of crop harvested?" There are two very good reasons for that. The first is an administrative one. It would be utterly impossible to check every quarter of wheat that was grown. It would mean a perfect army of inspectors and checkers all over the country, at every threshing, at every miller's, and I am sure farmers would be the first to complain of any further invasion of that kind. (Hear, hear.) Secondly, it would operate hardly against the man with light land, and we particularly want to encourage the growing of more wheat on the lighter lands. Therefore we take the average production of the whole country at four quarters an acre. If a man only grows two quarters on account of the pooriness of his soil he still will receive precisely the same amount of subsidy from the State under the guaranteed minimum price. Of course, he will not receive as much for the sale of his wheat as the man who grows five quarters, but he will get exactly the same guarantee subsidy as everyone else from the Government with regard to the acreage which he has sown. Whilst on this question of the lighter lands may I just say that the only way in which I believe this country can ever be made reasonably self-supporting, the only way in which wheat growing, and, indeed, farming of all kinds, can be made certainly profitable, and the only way in which adequate wages can be paid to the agricultural labourer—the only way in which all those things can be done on an economic basis—is that the average yield of all our crops should be increased. It is in this connection that we find the great value of the work that is being done here by Dr. Russell and his devoted staff and by great scientists like Professor Biffen and others. (Applause.) It is quite clear that it can be done. It is already being done on a small scale, and what we have got to do, by increased grants for education, and increased propaganda, is to make known to the whole body of farmers in this country the special discoveries and productions which have come from the work of these great institutions. That is the chief way in which production can be made more economical.

Science and Economical Production.—You cannot expect to make production more economical by cutting down the

labourers' wages. The higher wage has come to stay, and the way in which it can be paid and can be justified in an economic sense will be by an increased yield which may mean a little more labour but far greater profits. With regard to this, I think it is impossible to exaggerate the debt that the farmers of this country owe to the work which is being done here at Rothamsted and by Professor Biffen at Cambridge. I should like to say a special word about Professor Biffen because he is one of those extraordinarily modest people who can never be found except in their laboratory but who are really great benefactors of their country. He is not a mere scientist who deals with experiments in a test tube; he recognises that wheat growing has got to be made worth while if it is going to be pursued in this country, and he is devoting his great abilities to finding out how you can increase yields, particularly on the poorer lands. The services which he and his fellow-workers have rendered in this respect are amongst the most remarkable that have been given to the nation for many years past. He has produced for you rust-proof wheat which means a saving in many cases of from four to five bushels to the acre. He has now produced for you practical varieties of "strong" milling wheats which will compare with the best milling wheats from North America and which will, if grown, bring you an additional 3s. or 4s. a quarter. As a result of this work, of which you see little but which must mean much to you when you adopt these discoveries in your practical work, he is persuaded, and it has got to be proved that he is wrong, that it is by no means impossible that the average yield of wheat in this country can be brought up from four to five quarters per acre. If that is done you have practically solved the economic problem at once, and a good many of these difficulties about wages and other costs of production will disappear. Make no mistake about this: England, whether with regard to its soil, or its climate, or anything else, is probably the finest wheat-growing country in the world. We grumble at our weather; we grumble at our many difficulties, but they are nothing to what growers have to compete with in other countries. We do not make half enough use of our soil, and the present area under wheat must be increased in the national interest.

Control of Cultivation.—That brings me to another point with regard to which the critics are very severe. They object to that part of the Bill which deals with control of cultivation by the County Agricultural Committees. I sympathise with

what Lord Hampden said just now, not only with regard to agriculture but with regard to everything else in our national life. I also much dislike control. We have had a great deal of it during the War, necessarily, and we should all be glad in theory to get rid of it. (Hear, hear.) But when it comes to actual practice I do not always find that I get the same agreement. When I first went to the Ministry of Agriculture I tried very hard, as some of you know, to get rid of the control of home-grown meat, and I got a great deal of assistance in that direction from some farmers, but an even greater volume of opposition from other farmers. They said: "No, let us keep the control. We know where we are and we are not sure that we should get as good profits if it were taken off." It is not by any means always the case that farmers who call out loudly for the removal of control really want you to do it when it comes to some particular commodity in which they are interested. Let me take this as an illustration. If you had control taken off fertilisers to-day and we were not controlling the export of fertilisers so that they could not get a world market, the price of your sulphate would jump from £23 to £50 per ton. That is what the foreigner is willing to pay for it to-day. It is only by Government control, keeping the fertilisers in this country, that you are getting them at little more than one-half the average world price. So control sometimes has its merits! Let me say this with regard to the control of cultivation. The good farmer has absolutely nothing to fear from the measures of control which are contained in this Bill. There is no suggestion there, or possibility, of any great compulsory scheme of ploughing grass lands such as we had to engage in during the height of the submarine campaign. May I say with regard to that that I am the sinner who did it; and I will tell you why. I was in charge of the Food Production Department then and my instructions were perfectly plain. They were to produce more food, at any cost, in order that we should not run the risk of starvation and disaster in case the submarines succeeded in cutting us off. That was no time to consider "good husbandry" or to consider whether to plough this field or that field might do injury to a particular man. We did not pretend it was good husbandry; but we are not going to take that line now. We are in times of peace, thank goodness, and good husbandry is the thing we wish to consider before everything else. The powers we are taking in the Bill are those which are absolutely necessary in order to deal with bad farming. I venture to

say that the bad farmer is a curse to the industry. (Hear, hear.) He gets no sympathy whatsoever from the great majority who are farming properly. They recognise him as a danger to the industry and I hope he has got no friends. At any rate, we must reserve the right, in the last resort, to make him do his duty by the land and by the nation. And remember that a very large section of this Bill—one-half of the Bill—is devoted to giving increased security of tenure to farmers. But we do not want to give any increase of security of tenure to bad farmers. It would be a disastrous result of the land tenure part of the Bill if as a result the bad farmers, of whom I am sorry to say there are a certain number in this country, were fixed in their tenancy. That would not be in the national interest. (Hear, hear.)

Control and State Assistance.—Therefore the State must retain the right, in exchange for these special privileges which it is giving under the Bill, to insist that land shall be used to the best advantage—not in an uneconomical sense, but in the way of the best husbandry. There is no doubt about it, Parliament would never pass a Bill of this kind unless we coupled with the guarantees a reasonable measure of control. Certainly I am not prepared to work for guarantees and to get these special privileges unless the people who get them recognise at the same time their responsibilities to the nation. In this respect I say we must have the whole of the principles of the Bill or none. The Bill, of course, can be criticised and amended in detail; but the principles must stand and they must stand all together. They all form part of one coherent policy. Let me repeat with regard to those who are trying to stir up prejudice by saying that we contemplate some great compulsory ploughing campaign, that those fears are groundless. We are working on lines of achieving our object by inducement, not by force. We are doing it by making it worth the while of the farmer to increase his arable cultivation, with the addition that if it is made worth his while we feel he has no excuse to ignore the national need. In this matter public opinion is deeply interested. Public opinion is going to be brought to bear upon this industry through the Press and through the eyes of every consumer. You will not be able to ignore public opinion, and I have not the slightest reason to suppose that any of you wish to do so.

The Need for Confidence.—In the meantime we must do our utmost—I appeal to you all to do your utmost—to what I will call “stop the rot” with regard to lack of confidence

in arable farming. (Hear, hear.) There is, of course, resistance—positive resistance in some quarters—to any ploughing of grass land at all. I was sorry to see the other day that my friend, Lord Bledisloe, who is well known to all of you, completely misunderstood what our intention was with regard to this matter, and thought that under some clause of the Bill we were proposing to “destroy the fine green swards” throughout the west of England. Certainly nothing could be further from our intention. But we make no secret of the fact that we hope for, and expect, a large increase of wheat growing as a result of the provisions which we are making in this Bill. I believe we shall get it, and when we meet with the objection of people who say: “This grass land contains stored-up fertility; it would be unfair to the owner of the land if that stored-up fertility were used for the purposes of the tenant,” I have to say: “How long is it going to be stored up? How long is the talent to be wrapped in a napkin and kept in the ground?” If ever there was a time in the history of our country, now is the time for this fertility to be put into circulation. (Hear, hear.) We make ample provision in the Bill for full compensation to any landlord whose stored-up fertility is appropriated by a tenant, and who, perhaps, is leaving his holding. But we see no reason why the compensation should be more than the full loss actually suffered, and that is the meaning of Clause 16. At the other end of the scale we have got to consider the means of preventing an undue amount of seeding of arable land down to grass. Let me say at once that I recognise it is desirable that some land which was ploughed up during the War under the stress of the submarine campaign, and which proved to be unsuitable for corn growing, should be seeded down to grass. But in such cases we must insist that it should be done properly, and we must fight against a timid, retrograde, and unpatriotic policy of simply seeding down in order to avoid some of the difficulties—passing difficulties as I hope they are—with regard to labour and other matters.

Arable Farming and Improvement of Pastures.—Make no mistake about it, if a campaign of reducing our arable cultivation succeeded to any extent, if there was any general seeding down of arable land to grass, you would have in this country a counter-agitation for the nationalisation of the land—for taking away the land altogether from those who were doing this and for breaking it up and distributing it amongst smaller holders. I do not know whether you wish to see that, but

something must be done to check this, what I can only call, disastrous tendency to reduce the arable area in some districts. It is for that reason mainly that these powers to control cultivation are given to the County Agricultural Committees. They must have those powers, and I wish to make it quite clear that I intend, in so far as I have the power, and in so far as the Government have the power, to stick to this part of the Bill. But, concurrently, we see the importance of giving every assistance to the improving of existing grass lands. The Ministry has engaged in a very extended and important campaign with this object in view. I think many of you may have already seen something of it; but I should like to say how much you all owe to the devoted and unremunerated work which is being done in this connection by Professor Somerville, Professor Stapledon, Mr. Jenkin, Professor Gilchrist and others, who are devoting their time to going about the country assisting farmers with their advice and practical demonstrations.

The Food Outlook.—I only want to say by way of conclusion that I have been accused of "scaremongering" in connection with this Bill in order to try and assist its passage; that is to say, I have been charged with trying to frighten the people to believe that we may be short of food in this country when as a matter of fact there is no such fear. I hope there is no fear that we may have to go short; but at any rate I honestly believe—if I did not believe it I would not say it—that there is real cause for anxiety about the wheat supply of the world in the coming year and the years to follow. I know the evidence is very conflicting; I know the prospects are necessarily uncertain; I know there are many people interested one way or the other in giving this or that aspect of the facts. But my main contention is that there is not anybody who really *knows* what the food position is going to be in the world in the next twelve months. That being so, my policy at any rate, and I say the only sane and sound policy, is that we should take no avoidable risks. (Hear, hear.) It is quite true that I doubt, even with all the assistance that may be given to us by Rothamsted and the scientists, that we should ever be able to make ourselves fully self-supporting, in the ordinary sense, in this country. But I am quite clear from the experience of the War—and I am glad to see that Lord Ernle in his article to which I have just referred agrees with me—that we could without doubt grow enough food in this country, on our own soil, to enable us to support ourselves on a system of strict

war rations during any future war, and in that respect make ourselves safe against any development of the submarine campaign. Personally I shall never be satisfied—I shall never cease striving, whether in or out of office—until that moderate and prudent measure of national insurance and security has been attained. I am sure it can be done, and it is in the power of British farmers to do it. For that reason, and on this occasion, I make the most earnest appeal of which I am capable to them to respond generously. The Government in this Bill has endeavoured to play its part. We now ask the farmers of this country to play theirs. In doing so, not merely would they be doing what I believe is in the interests of themselves, in the interests of their labourers, and in the interest of the whole economic situation—but they will be rendering, as they have rendered more than once in the past, one of the greatest services that can be rendered by Englishmen to their country. (Loud applause.)

Mr. E. W. LANCFORD, J.P.—(President of the National Farmers' Union), also spoke, and said (in part):—

We have waited impatiently for the pronouncement of the Government as regards agriculture. We have the policy in the Bill. It does not go quite so far as some farmers of England expected it would go. It does not offer the panacea for all the difficulties with which we are confronted, and it does not solve all the problems with which we are confronted, but it is an honest endeavour to put into the Bill the pledges given in the Caxton Hall speech by the Premier.*

The nation is calling at this moment for an increased amount of arable land, and I hope every farmer will respond. If it is to be on a sound and profitable basis, and if it is possible for us to extract such crops and sell them at such price as to ensure a profit, I hope every farmer will do his best to carry out the main principles of the Bill to produce the increased foodstuffs of this country. To enable this to be done there must be absolute confidence in the mind of the farmer. The farmer is prepared when this confidence is given to him to do his level best with the land in this country.

I believe, if we stand firmly behind the Ministry, the Minister of Agriculture, realising, as he does, the importance of the food production of this country, will stand by the Bill, and it will be our turn when it becomes an Act of Parliament so to support him by increasing the food and land under the plough that the

* A report of this speech was published in this *Journal*, November, 1919, p. 772.

country will never have cause to turn upon him and say, "You led us wrong." The farmers should carry out the bargain if they are given this security. It is up to us to give all the support we humanly can. It is the best Bill that has ever been brought before the House of Commons in the industry in which we have been engaged. I hope it will come through the House without the main principles being interfered with. Then we will go forward to produce the foodstuffs so essential to the well-being of the country.

MORE WHEAT.

SIR DANIEL HALL, K.C.B., F.R.S.

FEW questions are of more importance, not merely to the farmer but to the whole community, than the prospects for the production and price of wheat during the next year or two.

Production and Imports, 1909-13 and 1918.—In order to understand the situation we may begin by comparing the production and imports in the years immediately preceding the War with those in 1918.

Wheat Imports.

		<i>Average 1909-13.</i>		<i>1918.</i>	
		<i>Cwt.</i>	<i>Per cent.</i>	<i>Cwt.</i>	<i>Per cent.</i>
Home Production ..					
United Kingdom ..		31,950,246	21·3 ..	49,899,000	34½
Canada		24,678,948	15·1 ..	23,697,450	16·4
Australia		12,423,203	8·3 ..	4,345,783	3·0
India		19,393,056	12·9 ..	719,594	0·5
U.S.A.		26,336,680	17·6 ..	49,706,360	34·4
Russia		15,788,123	10·5 ..	—	—
Argentine		16,848,870	11·2 ..	14,391,067	10·0
Other Countries ..		4,640,716	3·1 ..	1,697,912	1·2
Total Imports ..		118,109,596	78·7 ..	94,558,166	65·5
Total		150,059,842	100·0 ..	144,457,166	100·0

In 1918 we had, perforce, reduced our consumption from 150,000,000 cwt. to 144,000,000 cwt. Home production had been stimulated from an average of under 32,000,000 cwt. to nearly 50,000,000 cwt., so that it formed 34½ per cent. instead of 21 per cent. of the consumption. Shipping difficulties had almost wiped out the imports from Australia and India, Russia was no longer an exporter, and the quantity obtained from the Argentine was somewhat reduced, but the United States came forward with nearly 50,000,000 cwt. instead of 26,000,000 cwt. in the pre-war years.

Nineteen hundred and nineteen saw the British production drop from 49,899,000 to 37,135,714 cwt., but the United States and Canada sent 71,613,142 cwt., and Australia again made a substantial contribution. What are the prospects for 1920?

Prospects for 1920 and 1921.—For the cereal year 1919-20 the imports into this country will be about 100,000,000 cwt., and the requirements for 1920-21 may be set at a rather higher figure, say 110,000,000 cwt., in view of the unascertained but still certain decline in the acreage sown with wheat in the United Kingdom for the 1920 crop.

The acreage sown with wheat in America, from which the main export to Europe is derived, shows a considerable decline, something like 25 per cent.* Against this there is estimated to be a carry over of something more than 60,000,000 cwt. from the 1918-19 crop.

India has a good crop and an exportable surplus, and Argentina has also an exportable surplus from its 1920 crop, though there are doubts whether Europe can get it.

Australia has no longer any accumulated surplus, and with the bad season it has just been going through the prospects of export from its crop of 1921 are very problematical, while export from Russia cannot on the evidence before us be expected.

In any case, after taking into account the North American carry over, there is a very narrow margin for safety, and there are two factors in the question that cannot be estimated. There is the demand from France, Italy and Belgium, which in 1918-19 amounted to something more than 110,000,000 cwt., and the entirely unknown demand, unknown both as to extent and the financial capacities of the countries to pay for it, from Central Europe, where, however, good crops are expected. Again, the non-European countries, particularly Japan, are becoming greatly increased wheat eaters, and will cause an additional strain upon the world's supply.

There is no department in which prophecy is more dangerous than that of food supply, but in view of the fact that under the most favourable view the world will only get through the year 1920-21 in virtue of the American surplus, and that every civilised country shows the same phenomenon of a withdrawal of labour from the land, we cannot escape from the conclusion that wheat will be short in the world for some years to come—so short that any bad crop in one of the great producing countries may result in something like famine conditions.

* *Wheat Acreage.*

		1919.		1920.	
U.S.A.	{ Winter	..	49,905,000	..	38,770,000
	{ Spring	..	23,338,000	..	19,487,000
			<hr/>		<hr/>
Canada ..	..	..	73,243,000	..	58,257,000
	..	..	19,126,000	..	17,000,000

Urgent Need for an Increased Arable Area.—The nation is in urgent need of an increased acreage of land under the plough in order to provide the greater production of food which is possible on the arable land as compared with grass. In more normal times it is not necessary that a large proportion of that arable land shall be cropped with wheat, although on ordinary soils wheat must always be a considerable item in the rotation. The farmer will naturally grow the crops which happen to pay best under the existing market conditions. The essential feature is that the land shall be under the plough and so producing on the higher level; and, again, always ready to turn over to wheat should the emergency arise. That emergency is, however, in being for the next few years.

As we have seen, the wheat production of the world is short and the people must be fed. In consequence, for the next few years wheat is likely to pay as well as any other general crop, and it is to the interests of the farmer as well as the community to set about an immediate increase in the wheat acreage.

It is a common argument that the acreage under wheat in this country has more than reached its paying limit, that in 1914, or thereabouts, all the land fit for wheat was carrying what crop in the rotation, and that the remaining land was of a class from which only an indifferent and unprofitable crop could be expected, 3 instead of 4 quarter land. This idea, however, that the bulk of the land in this country is unfit for the growing of wheat, is not borne out by the past history of agriculture. The acreage under wheat in 1869, the highest year for which exact records exist, was 3,969,000; it had fallen to 1,905,000 in 1914, rose again to 2,793,049 in 1918, but fell to 2,370,367 in 1919, from which figure a further reduction may be expected in the current year.

Land on which the Wheat Area has declined since 1872.—Let us examine the classes of land on which the shrinkage of acreage since 1872 has chiefly taken place. In the first place it is notorious that the very heavy clays in the south and east of England, upon which good crops were grown before the great depression, have very largely been laid or tumbled down to grass because the heavy costs for labour involved in keeping such land under the plough could not be paid for at the low prices which prevailed for arable produce during the 'eighties and 'nineties of last century. Some of this land was compulsorily ploughed up during the War, but is now reverting to grass, so much are farmers apprehensive of the great rise in the cost

of labour. Many farmers, however, in such districts as, for example, Essex, have learnt how to handle such land with success and are still extensive wheat growers.

Secondly, there is the very large area of indifferent clay land over the Midlands, not nearly so heavy and intractable as the clays of Essex and the eastern counties, but which still has been lost to the plough during the last forty years. Over this area labour is very short, and even where arable farming is still practised the cultivation is indifferent and the soil is habitually worked to a very shallow depth.

There are, again, the large tracts of lighter lands, as, for example, upon the chalk loams themselves, where arable farming has largely given place to dairying. Though this land is eminently suited to the plough, and though it does not carry first-rate grass, it has been laid down because of the better returns that accrued from grass farming and dairying in the years immediately before the War.

Lastly, there exist many of the lighter lands which, though still ploughed, are regarded as unsuitable to wheat, and did not yield large enough crops to pay at pre-war prices.

On all these classes of land wheat may be greatly and profitably extended by taking full advantage of the recent developments in mechanical cultivation, the proper use of manures and the planting of reliable seeds.

Wheat not exacting as regards Soil, Climate, etc.—What one has to remember is that so far from it being necessary to reserve only the best soils for wheat, the wheat crop is really one of the least exacting of all as regards climate and soil. Again, it can be made one of the cheapest of all crops to cultivate. We have only to turn to the examples afforded by new countries to see the truth of these statements, for there we find wheat not only cultivated under the most diverse conditions, but regularly employed as the first crop wherewith to break in the wilderness. Other and more delicate crops may follow, but in the first years the produce is often confined to wheat.

Furthermore, practically the whole of the operations connected with wheat growing can be performed wholesale by mechanical power, from the preparation of the soil, seeding and manuring on to harvest. The most typical example is afforded by the single-handed Australian farmers in their wheat areas; they regularly plough, sow and harvest 120 acres or more without any assistance, and at the same time cultivate the bare fallow which is to be the preparation for the next year's

crop. No one wants to grow wheat in this country in that fashion, nor does one need to do so, but it does show how susceptible the crop is to labour-saving devices.

Conditions for growing Wheat on Inferior Land.—If a payable crop of wheat is to be ensured upon the inferior land of this country certain essential conditions must be observed; they hold, of course, for all wheat growing, even though they may to some extent be neglected on the best wheat soils where conditions are so favourable as to make up for the set-backs the plant may suffer.

Early Sowing.—In the first place we put an early start. On the heavier, colder and higher soils we can only expect a good wheat crop if it is sown before the end of October, and the early part of that month or the end of September are better still. The early start makes much more sure of the establishment of a plant that will stand the winter, germination is better and the plant gets its roots down before the soil becomes waterlogged. This, again, makes to some extent for early and even ripening; above all it helps the plant to stand up as harvest approaches. Of course, on the best land early sowing may result in the wheat becoming "winter proud," but thin seeding obviates damage from that cause.

Manuring.—The next point to be considered is that for wheat growing on the poorer land some corrective manuring is generally necessary. Wheat is often regarded as a crop that requires no special manuring beyond the residues that remain from the manures applied during the rotation, and perhaps a dressing of sulphate of ammonia or some other nitrogenous fertiliser in the early spring, which greatly benefits the yield; but on the heavier and colder soils it is, perhaps, more necessary to apply a dressing of basic slag before the crop is sown. This promotes earlier ripening and better root development, and also helps the crop to stand up. On the very lightest soils, again, wheat cannot be profitably grown without some potash manure.

Good Seed.—Thirdly, it is difficult to exaggerate the importance of good seed. There are several of the newer varieties, among which we may instance Yeoman, Little Joss, Svalöf Square Head, and Swedish Iron, which can be counted upon to give two or three more bushels per acre than the old varieties. It is unsafe to specify a particular variety.—Little Joss, for example, does not answer well on land which lies wet and cold during the winter—but the local Agricultural College or Farm Institute can generally advise as to the best cropping wheat for the particular locality.

Quick Harvesting.—The last point on which we may insist is the necessity for ample power and some degree of hustle at the harvesting. There are seasons, like 1918 proved in the north and west, when the weather is uniformly adverse, but in most years the determined farmer can get his wheat safely stacked in good condition if he takes full advantage of the intervals of fine weather that are granted to him. It is here, as with early sowing, that the tractor can be made so useful. Again, wheat can safely be cut a little earlier than is the custom without the danger of the loss of quality that, for example, attends the premature cutting of barley.

Special Cases.—Heavy Clay.—Returning now to special cases that have been enumerated above, on the heavy clay lands the preparation either of old grass land or temporary leys should begin at once with a deep steam ploughing as soon as the hay crop has been secured. Unless conditions are favourable it is generally necessary to do this first preparation of land with steam or with one of the heavier types of tractor, because either with horses or the lighter tractors it is difficult to make the plough hold the ground. When the land is still too hard to plough a cultivator may be used. What is wanted is to get the land turned over and the clods baked through with the sun. As soon as the soil is dried out and a considerable proportion of the grass has been killed, a second cross cultivation should follow, and here, again, it is generally necessary to use steam or the tractor, as horses find it difficult to work on the rough clods. With any sort of luck in the way of weather, a third cultivation ought to leave the land ready for sowing at the end of September or early in October.

The use of wide drills, harrows and rollers drawn by mechanical power is necessary if the costs are to be properly kept down. As has already been mentioned, basic slag should be sown before or with the seed. Machines have been devised which combine a clod crusher with a seed and manure drill, and to which harrows can be attached, so that the whole of the latter operations can be completed at a single stroke. It is to the extended use of machines of this type that the farmer must look for rendering wheat growing, and indeed the cultivation of any cereal, profitable.

Lighter Land.—The same considerations apply to the second class of land, the rather lighter class in the Midlands, but where these have been habitually worked only to a very shallow depth of 4 or 5 in. it may not be wise to plough so deeply at first. It is essential to break up the pan which long-continued

shallow cultivation has produced on these soils, but to go down to a depth of 10 in. or more runs the risk of bringing up too much infertile subsoil, and the deepening of the tilth should be done more slowly. On most of this land, if it is not baked too hard, any kind of tractor can be used for breaking up.

Other Land.—The third class is any farmer's land, and does not require such special care in its cultivation. None the less a better wheat crop will result if the land is broken up early, in time to take a half fallow, than if it is held back for autumn cultivation and later sowing of wheat. On the lighter sands the success of the wheat crop depends upon manuring. Five cwt. of basic slag must be sown, together with 3 or 4 cwt. of potash manure, and a spring dressing of sulphate of ammonia, or, better still, of nitrate of soda, must follow. The extra expense of manuring on this land is made up for by the cheapness of cultivation. Early sowing is again essential, because it is necessary to establish the wheat with a deep root system before the droughts set in in the spring. Such land, because of its early ripening powers, will grow spring wheat, but success depends upon luck in the matter of weather, and very often spring-sown crops will fail because the absence of rain in the early part of the year does not enable the plant to establish a root system which will render the crop independent of the droughts that are sure to affect the surface later. On this class of land, again, rolling, in order to consolidate the soil and make the most of the lower moisture, is all-important.

Cost of Wheat Growing.—The cost of production is so entirely determined by local conditions, the equipment of the farmer, and the weather experienced in the particular season, that any estimate based upon averages is of little service to the individual, particularly as the returns both as to yield and price are equally matters of speculation.

Of late years, however, on second-class land wheat has generally proved to be the most paying crop upon the farm, and having regard to the considerations urged above as to the prospective shortage of supply all the world over it can hardly fail to be a profitable speculation for some years to come, even at present costs of labour.

On second-class land the farmer must exercise greater care and adopt the precautions which have been indicated in order to secure a reasonable yield. Moreover, whether it is for wheat or any other crops, the farmer has got to consider in every possible way how the costs can be reduced by the

adoption of large-scale methods of production—big fields, tractors or steam, wide implements, etc. This may involve some initial capital outlay, but farming in the future is not going to be successful without such outlay and a determination to take advantage of all recently-developed resources in the way of labour-saving machinery and improved methods.

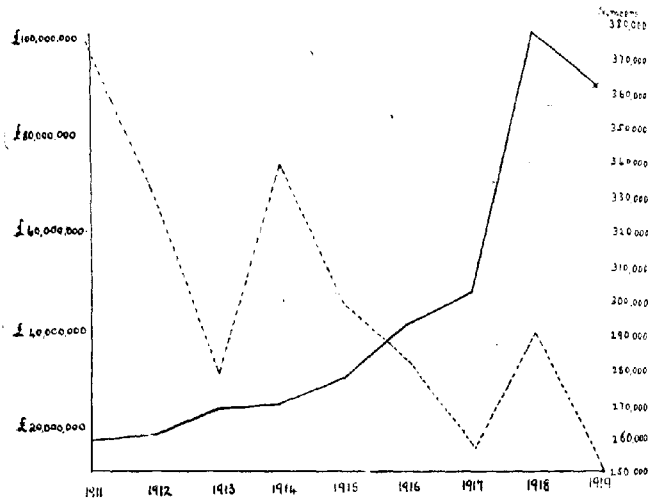
The world is in serious need of wheat, and over a much greater acreage than is now devoted to the crop the British farmer is as well placed as any others to meet that need at a profit to himself.

PIG FEEDING AND THE COST OF PORK PRODUCTION.

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It may seem strange that at the present time, when bacon is commanding such a high price in the market and the value of imports has so largely increased, there should be a decline in the number of pigs, especially of breeding sows, kept in England and Wales. The total value of the ham, bacon and pork imported into the United Kingdom has increased from just over £18,800,000 in 1911 to more than £90,000,000 in 1919, yet during the corresponding period the total number of pigs in England and Wales has declined from 2,651,039 to 1,798,468, a decrease of 32 per cent.



Graph showing (1) The Value of Pig Meat imported annually into the United Kingdom, 1911-19 (black line); (2) The Number of Breeding Sows in England and Wales, 1911-19 (dotted line).

During the same years the number of breeding sows in England and Wales fell from 375,583 in 1911 to 250,752 in 1919, a decrease of more than 33 per cent. While there was a very marked fall in the number of breeding sows kept in 1912 and in 1913, a partial recovery occurred in 1914, after which the reduction in numbers, owing to the influence of the War, is

most marked. The great reduction in the number of pigs kept from 1915 onwards can most probably be accounted for (1) by the increasing difficulty in securing supplies of food for them, and (2) by the widely prevalent idea that the high prices of pig meal and millers' offals made the production of pork economically unsound. In spite of the high prices for the raw material in the manufacture of pork, the writer has found in nearly all the cases investigated by him that the keeping of pigs, even in the later years of the War, could be made and was actually made a very profitable business. Now that feeding stuffs are more readily obtainable, and prices have fallen, it is to be hoped that full advantage will be taken of the improved situation, and that our output of pork, bacon and ham will be increased, so that we may be able more nearly to satisfy our own demands and to diminish imports. When the control price of pork was raised from 21s. to 23s. per live weight score, any doubts as to making a commercial success of a well-managed herd of pigs must have been set at rest.

Pigs on a Yorkshire Farm.—In these circumstances it was thought that the actual detailed records of the receipts and expenditure in connection with the management of pigs on a Yorkshire farm of just over 300 acres, during the year 1st April, 1918, to 30th March, 1919, might be of interest. The Department of Agriculture of Leeds University has for some time past been engaged in investigations into the cost of production of milk, pork, beef, mutton, crops and other farm products on a number of farms throughout the county, including its own experimental farm at Garforth. On these farms detailed valuations of the live and dead stock are made at the beginning and end of each financial year, either by a professional valuer or by a member of the staff of the Department of Agriculture in conjunction with the farmer himself.

On the farm in question, the 73 pigs in stock on 1st April, 1918, were valued by a professional valuer at £341. This number included 1 boar, 20 breeding sows and gilts, 21 stores and young gilts, and 31 suckling pigs. On 30th March, 1919, there were on the farm 1 boar, 22 breeding sows and gilts, 4 fattening pigs, 30 stores and young gilts, and 4 suckling pigs. These were valued by the same valuer at £614.

Records of all the farms under investigation are kept in a detailed Cash Book, showing receipts and expenditure in connection with the stock. These records showed that on the farm in question 92 pigs were sold during the year for a gross return of £911 3s. 8d. Arrangements have been made for the whole

of the stock on the farm to be weighed at the beginning and end of the financial year. In addition, any stock bought during the year is weighed at the time of purchase, and any stock sold is again weighed at the time of its sale. Under this system it is possible to ascertain the total live weight of pork, beef or mutton produced on the farm each year, and, if necessary, to calculate the rate of increase of each individual animal.

The weight of pigs produced during the year was :—

	cwt.	qr.
Weight of 92 pigs sold during the year	160	3
61 pigs on the farm on 30th March, 1919, weighed on that date	96	0
	<hr/>	
	256	3
73 pigs originally in stock, weighed on 1st April, 1918	55	2
	<hr/>	
Produced during the year	201 cwt. 1 qr.	

Time sheets and detailed records are kept of the daily labour of each man, horse or tractor on the farm, so that at the end of each week it is possible to apportion to each crop or kind of stock its proper share of the labour bill.

The weekly or fortnightly wages sheet is so designed as to include not only the cash wages actually paid, but also the monetary equivalent of that part of the wages paid in kind.

In addition, the Stock Book is balanced monthly, so that accurate information may be readily available as to the number of the various heads of stocks on the farms at any particular time.

Cost of Labour.—From the Daily Labour Sheets, Wage Book and Stock Book, information was collected from which it was shown that 254 days' man labour at a cost of £62 15s. 11d. and 15 days' work for a horse at a cost of £2 19s. 8d. had been utilised in attendance on the pigs, the total labour bill for which amounted during the year to £65 15s. 7d.

The cost of attendance per pig per week varied from 2½d. per head in July to 6½d. per head in March, with an average of just under 4d. per head per week throughout the whole year. This cost, however, only holds good when on the average one man is fully employed in looking after 124 pigs, and receives an average daily wage of 4s. 11½d., and when the average cost of horse labour is 4s. per day. The average daily cost of human labour in attendance on the pigs, viz., 4s. 11½d. has been arrived at by dividing the total cost of the labour, viz., £62 15s. 11d., by the total number of days' labour expended,

viz., 254. The resulting figure is low, mainly because most of the labour in attendance on the pigs was performed by women. If, as is probable, there has been an increase of 50 per cent. in the price of daily labour in respect of the year 1919-20, and the attendant still does the same amount of work, the cost of attendance per pig per week on that particular farm for the current year will probably amount to 6*d.* per head per week instead of 4*d.*, as during the period under notice.

The estimated cost of attendance per pig per week during November, 1919, worked out in respect of six farms, was as follows :—

On Farm A at 5*d.* per head per week.

"	B	"	5½ <i>d.</i>	"	"
"	C	"	6 <i>d.</i>	"	"
"	D	"	6½ <i>d.</i>	"	"
"	E	"	6½ <i>d.</i>	"	"
"	F	"	7 <i>d.</i>	"	"

Cost of Food.—Little difficulty has been experienced in checking the amount and cost of the purchased foods consumed by the various kinds of stock.

Rations are drawn up for all the stock, alterations are noted as they are made, and the amounts of the various foodstuffs consumed are apportioned monthly to the stock consuming them. The actual amounts consumed are checked with the estimated amounts according to the rations drawn up. This is done by making an inventory each month of the various foods still left unconsumed on the farm, and deducting the amount left over at the end of the month from the quantity in stock at the beginning, plus the amount purchased during the month.

The actual consumption never quite agrees, nor, in fact, can it be expected to agree, with the estimated consumption; but the one ensures the accuracy of the actual amount consumed, and the other enables one with as great a degree of accuracy as possible to apportion the amounts so consumed among the different kinds of stock. The purchased foods so consumed are charged to the stock at their actual cost price, including the cost of carting to the farm.

The home-grown foods, on the other hand, have all been charged at prices corresponding to their actual cost of production. These prices have in all cases been worked out as carefully as practicable.

Thus, the cost of growing 7½ acres of potatoes on newly-ploughed grass land was found to be £235 os. 4*d.*; and the whole cost of growing 11½ acres of potatoes on the farm

amounted to £355 6s. 9d., corresponding to £30 4s. 10d. per acre. The total yield was 111 tons, and the cost of production in respect of the 11½ acres, therefore, works out at £3 4s. per ton. Of the 111 tons produced, 76 tons were sold, and 5 tons were retained for seed; the remaining 30 tons represent what was fed to the pigs, and the unavoidable waste. The whole 30 tons were charged to the pigs at the cost price of £96 (*i.e.*, £3 4s. per ton).

Just over 11½ acres were under swedes, and lifted at approximately 21 tons to the acre. Rather less than a third of these were eaten by the sheep; a few went to the pigs and horses, and the remainder were consumed in fairly even proportions by the cows and other stock.

From this information, distribution of the total cost of growing the crop, *viz.*, £233 7s. 4d., was made in the following proportions:—£73 were charged respectively to the sheep, cows and bullocks, heifers and calves; £7 to horses; and £7 7s. 4d. to pigs.

Two and three-quarter acres were under mangolds, and the cost of growing the crop amounted to £58 17s. 5d. Of this amount £15 15s. was charged separately to the sheep, to the cows, and to the stock, £5 6s. to the horses, and £6 6s. 5d. to the pigs.

Four acres of peas were grown at a total cost of £38, but, owing to the prolonged rains of August and September, the crop was left out for at least six weeks after cutting, and consequently was harvested in extremely bad condition. No part of the crop was fit for sale, and it was, therefore, fed to the cows, bullocks, and pigs; £6 was considered the proportionate share of the total cost which should be charged to the pigs.

Thirty-nine and a half acres of oats were grown, yielding a crop of 315 qr., at a cost of £546 18s. 6d., of which sum £478 10s. 10d. was allocated to the grain and £68 7s. 6d. to the straw. The cost per qr. of the oats harvested works out at £1 10s. 6d., and the 51 tons of oat straw obtained were grown at a cost of £1 5s. a ton. Thirteen qr. or approximately 2 tons of oats were consumed by the pigs, and were charged to them at £20.

As the farm in question was approximately half arable and half grass, half of the salary of the farm manager, the wages of the farm mechanic, and of the various incidental expenses which could not otherwise be allocated, were charged to the arable land, and the remaining half charged to the stock in

proportion to the average capital value of these at the beginning and end of the financial year. The amount debited to the pigs for management and incidental expenses amounted to £60 11s.

Cost of Rent and Rates.—In addition to this, each class of stock has been charged its fair share of the rent and rates of the buildings used by them. Thus, of the £453 12s. 6d. actually paid for the rent of the farm, £20 has been charged to the horses, £25 to the cows, £30 to the bullocks, heifers and calves, and £18 to the pigs for the use of the building; the remainder has been distributed evenly over the grass and arable land at a rate which works out at £1 3s. 2d. per acre. Distributing the rates in the same way, the amount charged to the pigs as their share of the rates and taxes was £3 12s.

Profit and Loss Account.—A Profit and Loss Account for the year in which the pigs are debited with all the expenses incurred in respect of their keep, and credited with their valuation at the end of the financial year, the receipts from the sales during the year, and the manurial value of foodstuffs consumed by them, would show for the year a net profit of £414 19s. 5d. On the total capital outlay of £1,173 9s. 8d., the percentage profit would therefore be 35½ per cent.

The accounts kept on the above system show much more than the actual profits made by the pigs during the year. It is stated on p. 342 that the live-weight increase for the year was 201 cwt. 1 qr. The cost of producing this quantity is shown in the balance sheet to be £832 9s. 8d., so that the cost of production of the pork has been on an average £4 2s. 8d. per live-weight cwt., or 14s. 9d. per live-weight score. If the actual cost of keeping the pigs throughout the year amounted to £832 9s. 8d., and the average number of pigs on the farm throughout the year was 82 (see p. 342), the average cost of keeping a pig for one year would have been £10 3s. 1d.; or 3s. 11d. per pig per week. Of this 3s. 11d. the food bill absorbs 3s. 2d., and the labour bill 4d., leaving 5d. per pig per week for the various incidental expenses.

Information is available from the records which will enable a fairly accurate check to be made of the valuation of the professional valuer of the pigs in stock at the beginning and end of the financial year.

The 73 pigs in stock on the 1st April, 1916, weighed 55 cwt. 2 qr., and were valued at £341, equivalent to £6 3s. per live-weight cwt., or £1 1s. 11d. per live-weight score.

PIC ACCOUNT, 1918-19.		CR.			
	£	s. d.			
To Valuation of 73 pigs, 1st April, 1918 ..	341	0 0	By Valuation of 61 pigs, 30th March, 1919 ..	614	0 0
" Labour ..	65	15 7	" Sale of 61 pigs during year ..	911	3 8
" Rent and rates of buildings ..	21	12 0	" <i>Manure and other foods consumed—</i>		
" Management charges ..	13	5 0	19½ tons of pig meal ..	32	0 0
" Repairs and incidental expenses ..	47	6 0	2½ " fish meal ..	12	12 0
" <i>Purchased foods—</i>			1 " sharps ..	1	17 7
19 tons 10 cwt. pig meal ..	360	10 0	1 " bran ..	0	9 5
2 tons 4 cwt. fish meal ..	45	1 0	" mangolds ..	1	2 9
1 ton sharps ..	13	13 0	" swedes ..	1	2 9
5 cwt. bran ..	3	5 0	" peas ..	0	11 3
	431	9 0	" potatoes ..	9	0 0
" <i>Home-produced foods—</i>			30 " oats ..	2	3 6
1 acre mangolds ..	6	6 5	2 " barley ..	1	19 8
1 acre swedes ..	7	7 4	" separated milk ..	14½	
1 acre peas ..	6	0 0	22½ " whey ..	22½	
30 tons potatoes ..	96	0 0			
13 qrs. oats ..	20	0 0			
10 qrs. barley ..	18	0 0			
3,272 gal. separated milk at 5d. ..	68	3 4			
5,000 gal. butter milk and whey ..	31	5 0			
PROFIT ..	253	2 1			
	£	s. d.			
	414	19 5			
	£	s. d.			
	41,588	9 1			

By Valuation of 61 pigs, 30th March, 1919 ..
 " Sale of 92 pigs during year ..
 " *Manurial value of foods consumed*—
 19½ tons of pig meal ..
 2½ " fish meal ..
 1 " sharps ..
 1 " bran ..
 6½ " mangolds ..
 6½ " swedes ..
 30 " peas ..
 30 " potatoes ..
 2 " oats ..
 14½ " barley ..
 22½ " whey ..

* The 61 pigs in stock on the 30th March, 1919, weighed at that time 96 cwt., and were valued at £614, which would represent £6 8s. per live-weight cwt., or £1 3s. per live-weight score.

The total weight of the 92 pigs sold during the year amounted to 160 cwt. 3 qr., and the total receipts from these sales £911 3s. 8d., an equivalent of £5 14s. per live-weight cwt., or £1 os. 6d. per live-weight score. It would certainly seem as if the values of the pigs in stock, particularly at the end of the year, were over-estimated rather than under-estimated, and that approximately £20 might be struck off the net profits arrived at, as allowance in respect of possible inflated valuations.

Gain per lb. of Live Weight Increase.—Information is also available which will enable a check to be made in one or two ways as to the suitability or otherwise of the feeding of the pigs. Converting the foods consumed by the pigs into their equivalents of barley, according to the Danish standards, it can be shown that the pigs have consumed during the year the equivalent of 661 cwt. of barley, and in return for that food have put on a live-weight increase of over 201 cwt. If the pigs have put on weight at the rate of 1 lb. for the equivalent of every 3½ lb. of barley fed, there can hardly be anything radically wrong with the method of feeding adopted.

Incidentally, the accounts bring out the great efficiency of the pig as a machine for converting food into flesh, and its great superiority in this respect over any other class of stock. While on the farm in question the pigs put on 1 lb. of live-weight increase for the equivalent of every 3½ lb. of barley fed, the bullocks on the same farm only put on 1 lb. of flesh for the equivalent of every 7 lb. of barley fed. As the carcasses of the pigs have been on an average approximately 78 per cent. of the live weight, and of the bullocks approximately 54 per cent., the pigs have produced *one pound of pork for every 4.2 lb. of barley fed*, whereas the bullocks have produced only *one pound of beef for every 13 lb. of barley fed*. It follows, therefore, that the efficiency of the pig as a machine for the production of human food in the form of meat is more than *three times greater* than that of the bullock; a point which of itself is a very strong argument for the rearing of more pigs on farms at the present time.

Cost of Foods used.—While, however, as has already been pointed out, there was nothing very radically wrong with the method of feeding the pigs on the farm in question, it does not follow that the best or most economical method had been adopted. The purchased foodstuffs consumed during the year

by the pigs were equivalent in feeding value to 335 cwt. of barley, and were fed at a cost of £431 9s. They would, therefore, correspond to barley fed at £1 5s. 6d. per cwt. or £5 1s. per qr.

On the other hand, the home-grown foods consumed by the pigs during the year were equivalent in feeding value to 258 cwt. of barley, and these were produced at a cost of £153 13s. 9d.

They would, therefore, correspond to barley fed at 11s. 7d. per cwt., or £2 6s. 4d. per qr.

It is evident, therefore, that if pork is to be produced on the most economical basis, as large an amount as possible of home-grown foods should be available to feed them.

These figures also furnish data from which milk products such as separated milk and whey fed to the pigs on the farm may be valued. The 3,272 gal. of separated milk fed have approximately the same feeding value as 31 cwt. of barley. If the barley is valued at £1 5s. 6d. per cwt., the price at which the barley equivalents in the purchased feeding stuffs were purchased at the current rates, it means that the 3,272 gal. were worth roughly £39, and that the separated milk should be charged at 3d. per gal. for feeding purposes. Similarly, the 5,000 gal. of whey fed to the pigs have about the same feeding value as 36 cwt. of barley, and would, therefore, be worth approximately £45, or 2d. per gal. for feeding purposes.

Feeding Standards.—It is interesting, also, to note how closely the average ration fed to the pigs during the year adhered to the standards suggested by Kellner, and generally accepted both in England and Germany.

As the average weight of the 92 pigs sold during the year was 196 lb., of the 61 pigs in stock at the beginning of the year 100 lb., and the 73 pigs in stock at the end of the year 148 lb., it is most probable that the average live weight per pig on the farm throughout the whole year would be approximately 150 lb.

The daily ration, therefore, if it fitted in with Kellner's standards, should be such as to include approximately :—

30 lb. of dry matter	} per 1,000 lb. live weight per day.
2½ lb.—3 lb. of protein	
21 lb. of starch equivalent	

The total amount of dry matter fed during the year was 412.4 cwt., and of digestible protein 108.7 cwt. The starch equivalent of the dry matter fed was 494.6 cwt., from which it follows that the average daily ration fed to the pigs throughout the year actually contained—

26 lb. of dry matter per 1,000 lb. live weight per day instead of 30 lb. suggested by Kellner.

4 lb. of digestible protein per 1,000 lb. live weight per day instead of 3 lb. suggested by Kellner.

19 lb. of digestible starch equivalent per 1,000 lb. live weight per day instead of 21 lb. suggested by Kellner.

The daily ration, therefore, was slightly in excess of the requirements, so far as the digestible protein was concerned, and slightly below the standard so far as the carbohydrates were concerned. If 4 acres of grass, at a cost, approximately, of £10, and the produce from $1\frac{1}{2}$ acres of vetches, at a cost, approximately, of £12, had been placed at the disposal of the pigs, it is very probable that a saving of at least 3 tons of meal at £20 per ton might have been effected without in any way reducing the live weight increase of the pigs.

Conclusions.—In conclusion, the writer would wish to emphasise the importance of increasing our stocks of pigs on farms, and doing all that is possible to encourage the breeding and rearing of pigs. Such increase is desirable—

- (1) in order that we may to a large extent supply our own demand for bacon and ham and reduce to a normal figure our excessive imports of these commodities;
- (2) because there is no doubt that the pig is the most efficient machine for the production of human food in the form of meat;
- (3) because, especially, now that the prices of pig meal and millers' offals are showing signs of falling, the breeding and rearing of pigs should be economically sound and certainly remunerative;
- (4) in view of the importance of increasing, to as large an extent as possible, the production of cheap home-grown foods, and especially of making use of grass feeding, if the pork is to be produced on the most economical basis.

POULTRY KEEPING IN FRUIT PLANTATIONS.

G. H. GARRAD, N.D.A.,

Agricultural Organiser for Kent.

POULTRY keeping and fruit growing is an excellent combination. The poultry help the fruit trees by manuring the soil, and if the land has previously been under cultivation the birds will, by their scratching, keep it almost entirely free of weeds and reduce much of the expense of keeping the land cultivated. Moreover, they will consume innumerable caterpillars and other enemies of the fruit grower, and for a pest like the pear midge, the maggot of which falls out of the fruit to pupate in the ground, the keeping of poultry is the only practicable remedy.

This method of keeping poultry is also economical from the fowls' point of view, for they occupy ground beneath the fruit trees that would otherwise in many cases be unused, and they feed to a large extent on insects that are normally regarded as pests. They may occasionally do some damage to bush fruit and cob nuts by picking out some of the buds from the low branches, but this is not serious, provided that the birds are sufficiently fed. Heavy breeds of fowl like the Buff Orpington do less damage than the lighter breeds, because they do not climb so high into the trees.

The primary object of this article is to show that poultry keeping and fruit growing can be made a very profitable combination. During the past five years the writer has carefully checked the accounts of a small holder in one of the fruit-growing districts of Kent, Mr. W. Hall, of Grover Hill, West Peckham, near Maidstone. Mr. Hall and his son occupy 20 acres of land on the lower Greensand Formation, on the face of a steep hill facing the south, an ideal situation for poultry. His land is cropped as follows :—

- $7\frac{1}{2}$ acres standard apples, interplanted with cob nuts.
- $3\frac{1}{2}$ „ half-standard plums and damsons, interplanted with gooseberries.
- $3\frac{1}{2}$ „ half-standard apples, interplanted with gooseberries and cob nuts.
- 1 „ arable land.
- $4\frac{1}{2}$ „ grass land.

The poultry are confined in permanent runs in the $14\frac{1}{2}$ acres of fruit. At first it was the practice to dig the land over once a year, and the fowls then kept it well worked for the rest of the

season, but some of the ground has not been dug for two seasons, and there is not a weed visible on it. The birds' constant scratching keeps a tilth of fine soil on the surface, which doubtless is beneficial in keeping the moisture in the ground. Mr. Hall does not believe in deep digging, because it prevents the fine feeding roots of the trees from working their way close up to the surface of the ground where they can make full use of the manure from the poultry; he therefore only digs sufficiently deeply to enable the hoe to work afterwards. He also prefers a shallow tilth, because the caterpillars that fall from the fruit trees are then unable to bury themselves deeply in the soil, and are quickly consumed by the poultry. In years when there have been bad attacks of winter moth caterpillars among the nut bushes, he has made a practice of walking through the plantation and shaking each bush. The poultry follow and consume each caterpillar as it falls to the ground! Only young chickens are allowed to run among the gooseberry bushes, the hens being confined in coops; but hens if properly fed will not attack gooseberries (nor currants) until they begin to colour, and do a great amount of good by picking off the scale insects that are frequently so numerous on the stems of gooseberry bushes. Poultry are invaluable in dealing with the raspberry and loganberry beetle, but they will not attack the hairy sawfly caterpillars that often do so much damage to gooseberry bushes; only cuckoos will deal with these. The hens do not roost in the apple and plum trees, and do very little harm among the nut bushes, provided that the birds are not too closely penned. Mr. Hall allows his nut bushes to grow rather taller than his neighbours' bushes, but succeeds in growing quite as large a crop of nuts. Many of the nuts are not gathered until they fall to the ground, and the birds do not usually attack them, but once the birds have tasted the nuts it is impossible to prevent them from continuing to consume them. Windfall apples will, of course, be attacked by the birds; this is unavoidable, but they help in feeding the poultry and reducing the food bill, although it is not desirable that poultry should be allowed to gorge themselves suddenly with windfall apples. The position of the runs is not moved from year to year, but they are large, and the poultry are occasionally removed, in order that the ground may have a rest.

In an article in the issue of the *Fruit, Flower and Vegetable Trades Journal* for 13th October, 1917, Professor F.V. Theobald, F.E.S., Agricultural Entomologist at the South-Eastern Agricultural College, Wye, expressed his opinion that the em-

ployment of poultry as a means of checking some of the insect pests of fruit is a subject that deserves far more attention than it has hitherto received. He has found that by keeping poultry in both grass and cultivated orchards, the trees, even when not sprayed or banded, are much healthier than where no fowls or other stock are kept. Among the insects readily devoured by poultry he mentions the caterpillars and wingless females of the winter moth, the maggots of the codling moth, pug moth and pear midge, slugworms, various aphides, wireworm, surface larvæ, leather jackets, the raspberry, and many other weevils. As an example of what fowls eat in an orchard, he gives the analysis of the crop and gizzard contents of a White Leghorn chicken, a case taken at random out of a number of records that he has kept. This chicken, five weeks old, killed on 25th June, contained inside it 190 pear midge maggots, 127 aphides, 12 red ants, 2 tortrix caterpillars and 1 beetle, in addition to grain, seed and other foods. A Red Sussex pullet, killed on 30th April, contained 14 leather jackets, 10 fever flies, 2 wireworms, 4 cutworms, 5 beetles, 50 ants, 7 woodlice, 4 slugs, 1 millepede and 20 larvæ of the winter moth. The light breeds of fowl, such as Lèghorns, hunt the best and go further afield than the heavy breeds such as Wyandottes and Orpingtons, and in orchards of standard trees are the most suitable breeds to use for this purpose, but they will fly into bush trees or low half-standards and strip them when the fruit is ripe or nearly ripe, so that it is not safe to keep these light breeds in plantations of bush trees after the fruit is half-grown. The heavy breeds can be safely kept, even among bush fruit trees, but Professor Theobald has found that they are not such good hunters.

Without charging for rent or labour, Mr. Hall's poultry balance sheet has shown the following net annual profits for the last five years :—

Season.	No. of Birds at Beginning of Season.	Net Profit. £ s. d.
Nov. 1st, 1914 to Oct. 31st, 1915 ..	152 (138 hens & pullets)	104 1 8
„ 1915 „ „ 1916 ..	408 (140 „ „)	141 6 7
„ 1916 „ „ 1917 ..	542 (312 „ „)	112 1 5
„ 1917 „ „ 1918 ..	224 (224 „ „)	237 11 5
„ 1918 „ „ 1919 ..	285 (189 „ „)	419 19 1
Average of 5 years ..	322 (201 „ „)	£203 0 0

No rent has been charged against the fowls, because the ground is fully cropped with fruit, and the value of the birds' manure is estimated to be more than equal to any sum due as rent.

The cost of attendance has not been included, because it is difficult to estimate how much should be charged under this head. Mr. Hall and his son work the whole of the holding themselves, so that only a portion of their time can be charged to the poultry. They keep a cow, and also a pony for taking the fruit, eggs, poultry and other produce to market, and for working the holding. They used also to keep pigs, but they abandoned such live stock because they found that the pigs attracted rats, which caused very serious losses to the poultry. They also look after the whole of the fruit themselves, and pick the crop. Taking the year right through, Mr. Hall estimates that the attention given to the fowls amounts to about four hours per day by one person. In the winter season two hours a day is sufficient, but in the spring and summer the attention required is considerable. There are 13 poultry houses, and each house has to be cleaned out about once every three weeks. To clean out all the houses and to feed the fowls is a full day's work for one man. Up to 1917 £40 per annum was estimated to be a reasonable sum to allow for the cost of labour, but now that the minimum agricultural wage in Kent is 43s. 6d. for a 48-hour week a charge of up to £100 per annum might on present working be allowed.

Mr. Hall took up poultry keeping on a commercial scale for the first time in 1911 as the result of attending a course of lectures given by the County Council Instructor in Poultry Keeping, and he ascribes his success very largely to the instruction and advice he has received from time to time from the same source. He has been a Station Holder under the Ministry of Agriculture's Egg Distribution Scheme* since its inception four years ago. No expensive poultry houses or appliances are kept, nearly all the houses and runs being home-made. A 100-egg incubator has been used on one or two occasions in the past two seasons, but with that exception all the eggs have been hatched out under hens. The breeds of fowl kept are White Wyandottes, Buff Orpingtons and White Leghorns. They are general utility fowls, and at no time have any fancy prices been realised.

A few details of Mr. Hall's balance sheet during the last five years may be of interest. In addition to the head of poultry that are considered in this article, Mr. Hall's son has also kept about 100 head of Rhode Island Reds on the holding separately.

* Notes on this Scheme have appeared in this *Journal*, April, 1916, p. 72, October, 1916, pp. 685 and 702, December, 1918, p. 1106, and March, 1920, p. 1227.

as quite his own. He was successful in winning with a pen of these birds a prize at one of the *Daily Mail* Egg-laying Competitions at Bentley last autumn, four birds laying 286 eggs in the four winter months commencing 1st October, 1919.

The head of poultry on the holding on 1st November of each year, belonging to Mr. Hall, Sen., with their value, was as follows:—

Date.	Cocks and Cockerels.	Hens.	Pullets.	Chickens.	Total No. of Birds.	Value. £ s. d.
Nov. 1st, 1914 ..	14	67	71	nil	152	22 13 6
" 1915 ..	12	90	50	256	408	48 4 0
" 1916 ..	58	71	241	172	542	96 11 6
" 1917 ..	20	115	109	nil	244	49 10 0
" 1918 ..	15	106	83	81	285	48 10 0
" 1919 ..	23	168	122	84	397	73 18 0
Average of 6 years	24	103	113	99	339	£56 11 2

The cocks, cockerels and pullets have been valued every year at 5s. per head, and the hens at 3s. per head. The chickens have been valued at different prices according to their sizes, the average price being 1s. 6d. per head on 1st November, 1915, 1s. 4d. per head in 1916, 2s. per head in 1918, and 3s. per head in 1919.

The number of eggs sold for domestic purposes each year, with the average price per dozen, has been as follows:—

Season.	No. of Eggs sold.	Average Price per Dozen.	Total Receipts.
		s. d.	£ s. d.
1914-15 ..	14,231	1 9 ..	104 3 9
1915-16 ..	18,142	1 9 ..	134 7 7
1916-17 ..	26,545	2 8 ..	274 3 4
1917-18 ..	17,168	4 3 ..	310 2 5
1918-19 ..	22,675	4 5 ..	417 4 6
Total for 5 years	98,761	—	£1,240 1 7
Average per annum	19,752	3 2 ..	248 0 4

The prices realised have varied considerably from month to month and from year to year, according to the market price of eggs. Some of them have been sold wholesale, and others retail. The highest price realised was 8s. 4d. per dozen in October and 8s. 6d. per dozen in November, 1918, and the average price throughout the five years has been 3s. 2d. per dozen.

Eggs were also sold for setting as follows :—

Season.	No. of Eggs.	Average Price per Dozen.		Total Receipts.		
		s.	d.	£	s.	d.
1914-15 ..	nil	..	—	..	—	—
1915-16 ..	2,130	..	3 4½	..	27	10 11
1916-17 ..	3,185	..	3 5	..	45	12 10
1917-18 ..	2,010	..	3 5	..	45	9 0
1918-19 ..	1,912	..	6 8	..	53	6 0
Total for 5 years	9,237	..	—	..	£171	18 9
Average per annum	1,847	..	4 6	..	34	7 9

Sittings are sold each year at a definite price per sitting, which consists of twelve eggs if they have to be despatched, or thirteen eggs if they are called for. The cost of carriage and packing has been deducted in the table set out above.

Mr. Hall, as has already been stated, is a Station Holder under the Egg Distribution Scheme, and, in addition to the eggs already mentioned, he has sold the following number of sittings under the scheme :—

Season.	No. of Eggs sold.	Average Price per Dozen, in- cluding Govern- ment Grant.		Total Receipts.		
		s.	d.	£	s.	d.
1914-15 ..	nil	..	—	..	—	—
1915-16 ..	1,236	..	3 5½	..	17	16 0
1916-17 ..	972	..	3 9	..	15	2 6
1917-18 ..	720	..	5 2	..	15	10 0
1918-19 ..	392	..	8 8	..	14	7 1
Total for 5 years	3,320	..	—	..	£62	15 7
Average per annum	664	..	4 6	..	12	11 1

In 1918-19 the price charged for the eggs sold under the scheme was 7s. 6d. per sitting, exclusive of the Ministry's grant. This price proved to be too high, and very few sittings were sold in consequence.

Infertile eggs were used at home and valued at 1d. to 2d. each, as set out below. The hatching results are also shown in the table :—

Season.	No. of Eggs set.	Eggs hatched out.	Percentage of Fertile Eggs hatched.	No. of Infer- tiles.	Value per Egg. (Infertile.)	Total Value of Infertile Eggs.	
						£	s. d.
1914-15 ..	926	671	72	66	1d.	0	5 6
1915-16 ..	1,350	933	73	80	1d.	0	7 6
1916-17 ..	714	431	69	92	1½d.	0	11 6
1917-18 ..	1,989	—	—	128	1½d.	0	16 0
1918-19 ..	2,533	1,646	65	291	2d.	2	8 6
Total for 5 years	..	..	..	657	—	£4	9 0
Average per annum	..	..	..	131	1½d.	0	17 9

In 1917-18 there were also 165 small, cracked or double-yolked eggs used at home, which were valued at 2½d. each (£1 9s. 10d.), and in 1918-19 there were 99 similar eggs, valued at 2d. each (16s. 6d.).

During the last two seasons Mr. Hall has been selling day-old chickens, his sales under this heading being as follows :—

Season.	No. of Day-old Chickens.	Average Price per Chicken.		Total Receipts.	
		s.	d.	£	s. d.
1914-15-16-17 ..	nd.	..	—	..	—
1917-18 ..	798	..	1 0	..	39 18 0
1918-19 ..	1,013	..	1 4	..	66 13 8
Total (2 years) ..	1,811	..	1 2	..	£106 11 8

Birds of various ages have been sold or killed for home use from season to season as follows :—

Season.	No. of Birds sold.	Average Price.		Total Receipts.	
		s.	d.	£	s. d.
1914-15 ..	392	..	3 5	..	67 2 7
1915-16 ..	584	..	2 10	..	81 17 5
1916-17 ..	581	..	3 6	..	100 18 3
1917-18 ..	356	..	5 0	..	89 3 2
1918-19 ..	303	..	6 7	..	100 8 5
Total (5 years)	2,216	..	—	..	£439 9 10
Average per annum	443	..	3 11	..	87 18 0

The whole of the receipts have now been dealt with. The chief expenses, apart from labour, are food and appliances, but as the appliances are practically all home-made and home-repaired they have cost very little. The cost of the food, including cockle shell, consumed each year, and the cost of appliances, after allowing for depreciation at the rate of 10 per cent. per annum, have been as follows :—

Season.	Quantity of Food consumed. Cwt.	Cost of Food.		Cost of Appliances.	
		£	s. d.	£	s. d.
1914-15 ..	184	..	84 0 4	..	9 16 0
1915-16 ..	280	..	154 12 3	..	11 17 9
1916-17 ..	355	..	271 14 7	..	8 0 7
1917-18 ..	232½	..	244 2 8	..	3 4 9
1918-19 ..	200	..	254 3 4	..	17 8 5
Total (5 years)	..	..	£1,068 13 2	..	50 7 6
Average per annum	..	..	201 14 8	..	10 1 6

The foods used have been mainly middlings, maize, wheat, oats, fish meal, coconut cake and flaked maize, but rolled oats, meat and bone meal, linseed cake, poultry meal, chick meal, pig meal, rice, bean meal, pea meal, malt culms, dari, wheat

germ meal, groundnut cake, clover meal and bran have all been used at different times.

Mr. Hall has been his own carpenter in the manufacture of his appliances, and has made full use of old packing cases and similar articles of wood, which otherwise would have been used as firewood. The chief items in the account are creosote, nails and screws.

The only other expenditure has been for advertisements, postages, etc., which have averaged about £3 3s. per annum.

After allowing for the valuations of the feeding stuffs, poultry and appliances at the beginning and end of each year, it is possible to draw up a balance sheet and to ascertain the net profits and the return on the capital invested. It is desirable, before doing so, to put a value on the labour devoted to the poultry, and a sum of £40 has been charged for the year 1914-15, £50 for each of the two years 1915-16 and 1916-17, £60 for the year 1917-18, and £100 for the year 1918-19. The results shown by the balance sheet are then as follows:—

Season.	Total Receipts.			Total Expenditure.			Net Profit.			Capital Invested.		Return on Capital.	
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	%
1914-15 ..	233	12	10	169	11	2	64	1	8	52	13	6	121
1915-16 ..	400	11	3	309	4	8	91	6	7	82	1	0	111
1916-17 ..	540	19	0	478	17	7	62	1	5	129	3	8	48
1917-18 ..	649	5	8	471	14	3	177	11	5	104	10	6	170
1918-19 ..	788	3	5	468	4	4	319	19	1	146	16	9	218
Total (5 years)	£2,612	12	2	1,897	12	0	715	0	2	—	—	—	—
Average per annum	522	10	5	379	10	2	143	0	0	103	1	1	134

The capital invested has been taken as the value of the food, cockle shell, birds, houses and appliances, etc., at the beginning of each year. With the cost of labour as estimated above, and without charging rent, the net profit on the poultry has been £143 per annum, and on an average of the last four years there has thus been a return of 137 per cent. per annum on the capital invested.

It is not possible to publish here the complete balance sheets for the different years,* but a summary of last season's balance sheet is given as an illustration (p. 358).

It is evident that the poultry have proved exceedingly profitable. The five years under consideration have all been years of war, and prices have been high in consequence, but

* Full details of the accounts for 1915-16 and 1918-19 have been printed in the Yearbook of the National Utility Poultry Club, reprints of which can be obtained, price 2½d. carriage paid, from Mr. W. Hall, Grover Hill, West Peckham, near Maidstone.

POULTRY BALANCE SHEET.—From the 1st November, 1918, to the 31st October, 1919.

	Receipts.		Expenditure.		
	£	s. d.	£	s. d.	
1 22,675 eggs sold for domestic purposes at 4/5 per doz.	417	4 6	Value of food in stock 1st November, 1918.	70	13 0
2 1,912 eggs sold for setting at 6/8 per doz.	53	0 0	Value of cockle shell in stock, 1st November, 1918.	0	3 9
3 392 eggs sold under the Board of Agriculture's Scheme at 7/6 per doz.	11	18 9	Value of birds in Stock, 1st November, 1918—	3	15 0
4 Grant received from the Board of Agriculture for the above	2	8 4	15 cockerels at 5/-	15	15 0
5 291 infertile eggs used at home at 2d. each	2	8 6	106 hens at 3/-	20	15 0
6 99 small or cracked eggs used at home at 2d. each	0	16 6	83 pullets at 5/-	8	2 0
7 Received for rearing 166 chickens for other people	66	13 8	81 chickens at 2/-	16	2 0
8 1,013 day-old chickens sold at 1/4 each	11	5 3	Value of houses, appliances, etc., 1st November, 1918.	27	10 6
9 78 older chickens sold at 2/11 each	14	6 8	200 ½ cwt. food at 19/- per cwt.	1	197 7 1
10 29 live hens sold at 10/3 each	3	5 0	6 cwt. cockle shell at 5/4 per cwt.	1	12 3
11 11 pullets sold at 5/11 each	19	6 1	30 gallons of cresote at 1/- per gallon	1	10 6
12 28 cockerels sold at 13/7 each	51	2 9	57 eggs (Rhode I. Reds) bought for setting	1	14 0
13 149 birds sold for table at 6/10 each	1	8 0	Appliances purchased during the year	13	0 1
14 8 fowls killed for home use at 3/4 each	14	13 0	Advertisements, postages, etc.	5	10 8
15 Value of food in stock, 31st October, 1919.	0	16 0	Birds purchased during the year—	0	15 0
16 Value of cockle shell in stock, 31st October, 1919.	37	2 3	12 day-old White Wyandottes at 1/3	0	7 6
17 Value of houses, appliances, etc., 31st October, 1919.	27	10 6	1 Light Sussex cockerel at 7/6	0	7 6
18 Value of birds in stock, 31st October, 1919—					
2 cockerels at 5/-	5	0 0			
3 cocks at 4/-	0	12 0			
168 hens at 3/-	25	4 0			
121 pullets at 5/-	30	10 0			
84 chickens at 3/-	12	12 0			
	73	18 0			
	£788	3 5			
			PROFIT (rent and labour deducted)	..	419 19 1
					£788 3 5

No rent is charged in this Account, the ground being fully cropped with fruit and nut bushes, and the value of the manure is estimated to be more than equal to any sum due as rent. In addition, the birds work the ground and keep it free from weeds, thus saving a considerable amount of labour. The cost of attendance has not been included, as no actual figure can be given; a rough estimate would be about £100.

the price of feeding stuffs has been high, as well as the price of eggs and chickens. Every keeper of poultry cannot expect to get such satisfactory results; they can only be obtained by good management and suitable conditions. There is no question, however, that poultry keeping is an excellent adjunct to fruit growing for a small holder, and that with skill and knowledge profitable returns may be confidently expected. It is interesting to note that on 1st November, 1914, Mr. Hall possessed 152 head of poultry, of which 138 were hens and pullets, and that in five years he sold—

	£	s.	d.
98,761 eggs for domestic purposes at 3/2 per doz.	1,240	1	7
12,557 „ for setting at 4/6 per doz. ..	234	14	4
657 infertile eggs at 1½d. each ..	4	9	0
1,811 day-old chicks at 1/2 each ..	106	11	8
2,216 birds of various ages at 3/11 each ..	439	9	10
Total ..	£2,025	6	5

His stock at the end of five years had increased from 152 to 406 birds, and his food bill for the five years amounted to £1,008 13s. 2d.

TOMATO CULTURE.

J. STODDART,

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As a comprehensive leaflet dealing with tomato culture is now being prepared in the Horticultural Division of the Ministry, it is not proposed to deal fully with the subject in this article. Some points have therefore been selected which are not known to or are overlooked by many tomato growers, or on which opposing opinions are held.

Local Conditions.—No hard or fast rule can be laid down with regard to culture, as tomatoes are a crop which vary to an extraordinary degree with local conditions. It is advisable, on this account, for the grower carefully to observe and study the methods and results of other cultivators in his district. Varieties and methods which are quite successful in one part of the country may be of much less economic value in another part. Ruling climatic conditions, soil formations, etc., all have some effect on the ultimate success of the crop.

Soil and Sub-soil.—The habitat of most *Solanums* is a light and sandy soil, and in tropical countries they thrive in such a soil when other plants can scarcely gain a footing. This indicates a light soil for artificial culture, and practice bears it out. The ideal soil would be a light loam of fair depth over sand or gravel, or a well-drained alluvial soil. Heavy and successful crops are grown on brick-earth land where the drainage is good. Clay soils should, if possible, be avoided, as they predispose the crop to the many fungoid diseases for which there are no remedies at present. Where clay soil must be used, thorough drainage is essential, and the top soil should be heavily limed and thus made rich in humus and of good tilth.

Seed.—The proper selection of seed is easily the most important item of tomato culture. As one ounce of seed may produce £350 worth of fruit, the cost is of little importance so long as a pure strain of the most suitable variety is obtained. There are many excellent and well-tried market varieties offered, but these should invariably be purchased either from the original raiser or some firm of seed growers of good repute. The grower who, from motives of economy, saves his own seed, often defeats his purpose, as accidental cross-fertilisation may, in the course of a few years, take the strain clear away from the original, and the imagined economy thus prove in the end a considerable loss.

sowing.—The soil used for raising the seed should be fairly rich, and sifted through a medium sieve. Damping off of seedlings may, in many cases, be avoided by steaming the soil and boxes, or by treating them with a 2 per cent. solution of 40 per cent. Formaldelyde, before sowing. Labour in raising seedlings may be saved if, instead of sowing closely and pricking out the seedlings, the seeds are sown separately $1\frac{1}{2}$ in. apart in the seed boxes. By this means no removal is necessary until the plants are potted. A smooth board, fitting the seed box, and studded with hob-nails at the proper distances, is an easy method of marking the distances. A 'perforated iron plate, through which the seeds are dropped, may also be used for this purpose. During germination the boxes should be covered with glass and the temperature maintained at 70°F. Excessive watering encourages damping off, and all water used should be the same temperature as the soil.

Potting.—When the plants have reached a height of about 4 in. they should be transferred to small 60's pots, a moderately rich soil being used. One part of sifted straw manure to four parts soil is a good mixture. When the plants have reached a height of 9 in. to 12 in. it is customary to plant out direct into the final situation in the ground, but from observations over some 15 years the writer considers that it is advisable, particularly for early crops, to pot on into 48's, in order that the plant may throw its first truss of bloom. Plants which fail on the first truss can be discarded, and where the soil of the borders is rich the risk of rank growth of foliage and consequent failure of bloom is avoided. The extra labour involved is considerable, but is usually more than justified by results.

To save the labour entailed by handling a large number of small 60's pots, large boxes, 4 in. to 5 in. deep, are often used, the plants being spaced 4 in. apart. When this method is followed lack of uniformity results, and a large proportion of plants may be drawn and spindly. The risk of damage to the roots when separating for planting out is considerable.

Planting Out.—Distances and methods of planting must naturally vary with the size of the glass house. The average "plant" of large market nurseries is 17,920 per acre, or approximately $3\frac{1}{2}$ plants per square yard. In wide houses the usual method is to plant in rows across the house 27 in. and 18 in. apart alternately, the plants being 12 in. apart in the rows, leaving one, or in very wide houses two, paths along the length of the house. In low narrow houses three or four rows length-wise along each side of the centre path, with the plants 12 in. apart in the outside rows and 24 in. apart in the inner rows, is suffi-

ciently close planting if adequate ventilation is to be maintained. With this method the outside and inner rows only should be run up the roof, the other row or rows being stopped when the glass is reached.

Watering.—As soon as the plants permit, usually about a fortnight after planting out, or when the first truss of fruit is set, a mulching of straw manure should be given. In addition to supplying manurial material, mulching has an important effect on the water supply of the plants. It prevents rapid evaporation, and by keeping the surface of the soil in an open and moist condition encourages the roots to develop in the surface of the soil, where they are more easily controlled.

When the soil contains a plentiful supply of manure, water should be given very sparingly until the first truss is set, as otherwise there is a danger of the plants making a very rank growth and failing to set the first and second trusses. Where the soil is well drained a liberal supply of water should be given, not in frequent doles which only wet the surface, but in heavy waterings two or three times a week, according to the weather. When possible, it should be done on bright, dry days, in order that full ventilation can be given to disperse the damp air produced by the watering. Water, whenever possible, should be of the same temperature as the house, as cold water tends to check growth.

Stopping.—All lateral growths should be removed as the plant progresses, but on the question of "stopping" there are diverse opinions. Some urge that the plant should have further growth stopped as soon as the glass is reached, in order that all energy may be devoted to the maturing of the fruit already set. Others allow the plants to run up the wires and form a thick mass of vegetation, in order to crop as long as possible. Given a deep and rich soil at the start it is possible to run the plants on and get fruits which will average 6 to 8 to the lb., but if there is not enough body in the soil to do this, "chats" only result, and it is better to "stop" and clear the house for another crop.

Manuring.—Two distinct methods of manuring are in vogue, each of which has its supporters. The first is the addition to the soil of a sufficient supply of manure to serve the crop to the end, and the second is to plant in unmanured soil afterwards, feeding with frequent top dressings of soluble manures. Both methods produce successful results, but the writer is convinced that a longer crop finishing with good fruit is obtained by the first method. When the plants are old they do not seem to respond fully to the application of top dressings.

The question of the nature of artificial manures cannot be fully discussed here, but it is a safe rule to use organic materials where possible, in insoluble form, such as bone meal or flour when dug in, and dissolved bone or guano when used as a top dressing. Potash must, of course, be mineral and soluble.

Lime should never be overlooked, not because it is essential to the tomato, but because it assists the assimilation of the plant foods present in the soil and also possesses useful insecticidal properties.

Picking, Grading and Packing.—Fruit which is intended for distant markets should be picked at least 24 hours before it is fully ripe, as in this condition it travels better, and will be quite ripe by the time it is retailed to the consumer. The fruit should be graded as follows :—(1) *Pink*—fully coloured, uniform in size, smooth, round and firm, averaging 5 or 6 per lb. (2) *Pink and white*—good colour, uniform in size, smooth, round, and firm, averaging 6 to 9 per lb. (3) *Blue*—sound, shape and colour not perfect, smooth, round and firm, with no fruits less than 10 to the lb. (4) *White*—sound, colour and shape not perfect, small, and averaging 16 to the lb. (5) *Blue and White* or *Chats*—very small, undeveloped fruits. (6) *Pink and blue* or *Roughs*—large, badly shaped, diseased, and discoloured fruits. The colours given indicate the colours of paper used for lining the baskets. The chief packages used are 12 lb. chip and 12 lb. wicker strike, which should contain a full 12 lb. when packed. A label indicating the grade and net weight when packed should be tied on the outside of each package in such a manner that it is not removed when the cover is taken off.

Measures against Disease.—There are numerous fungoid diseases which attack tomatoes and for which there are no really satisfactory remedies when once the plants are attacked. Cleanly methods, careful attention to ventilation and watering, and the removal of all weeds both inside and outside the houses, promote a sound and healthy growth which enables the plant to resist attacks to a very large degree. Where successive crops are grown in the same soil, thorough disinfection of the house and sterilisation of the soil by one of the many carbolic preparations are essential.

In conclusion, the writer desires to impress upon readers the fact that the most important elements making for success in tomato growing are, careful work, careful thought, and clean culture. Methods may vary, but if these important factors are neglected a full measure of success is never attained.

FORAGE CROPS OF DEMARK.

W. H. PARKER, M.A.,

Director, National Institute of Agricultural Botany.

ON a casual glance through a current table of agricultural statistics, the eye will encounter the following item:—

"*Denmark*.—Acreage under roots for feeding (mangolds, swedes and turnips), 1919, 678,000 acres"—a bald statement, not worthy, apparently, of much serious thought on the part of the British agriculturist.

It has been part of Mr. Harald Faber's obviously congenial task* to prove the fallacy of such an impression; and well has he done his work. His book is small, only consisting of a hundred pages (exclusive of the excellent foreword written by Sir Robert Greig), but each one of those pages contains material which should be studied with care by all who have at heart the progress of British farming.

Growth and Improvement of Root Crops.—Mr. Faber has divided his material into four chapters, the first two of which deal mainly with roots. He starts by describing the prejudice with which Danish farmers of the 'sixties, 'seventies and 'eighties regarded the practice of growing roots for cattle feeding, and states that their main contentions were that cows so fed gave milk of poor quality, that the butter became tainted, and, especially, that it was uneconomical to grow a crop of which the largest proportion was water.

The first factor which contributed to the correction of these ideas was the publication of the results of a series of experiments carried out by N. J. Fjord, of the Royal Agricultural College, Copenhagen. In 1888 he started, in co-operation with certain Danish farmers, a series of practical feeding trials with pigs and cattle. The results obtained by 1890 may be summarised as follows:—(1) He proved that, with the exception of the criticism as to water-content, the farmers' objections were groundless; (2) It was shown that roughly 8 lb. of roots were equal in feeding value to 1 lb. of corn, but that the feeding value of different varieties of roots was directly proportional to their content of dry matter, 1 lb. of dry matter equalling 1 lb. of corn. The farmers soon calculated that one acre of land could, on this basis, either yield about 1,900 lb. of food as corn, or 5,107 lb. of dry matter of equal value, lb. for lb., when under roots. They grew roots but demanded varieties with small water-content.

Fjord's experiments were well planned, as every reader of

* Harald Faber: *Forage Crops in Denmark* (Longmans Green & Co., London, 1920, 6s.).

Mr. Faber's book will agree, and they were so designed that the conclusions to be drawn were obvious to all ; but, as regards scientific accuracy and refinement of method, they have since been completely outclassed by experiments dealing with the same problem carried out at Cambridge University between 1902 and 1909 by Wood, Berry and Middleton.*

The Cambridge experiments confirmed conclusively the results obtained from Fjord's trials, but it can only be with a sense of shame that the British agriculturist contemplates the contrast between the effects of these two sets of experiments in their respective countries. What these were in Denmark Mr. Faber describes most lucidly in his second chapter. He shows us how ready the Danish farmer has always been both to instigate and to profit by the results of research. Much had already been done towards the improvement of farm crops by selection, and the Danish Seed Testing Station (the earliest extant) had already made its influence felt in the direction of encouraging the use of home-grown seed. So it happened that all was prepared for the widespread application of the results of Fjord's work ; it only needed the man who should disseminate the knowledge and point out the best means of applying it. That man was L. Helweg, who had already started supervising and reporting on root trials in 1886. Everyone will follow with interest Mr. Faber's account of the succession of painstaking cultural experiments by which Helweg obtained evidence of the superiority of home-grown seed over that imported from the best foreign firms, and his investigations to discover which of the varieties gave the highest yield of dry matter per acre under varying conditions of soil and climate in Denmark. This, however, did not suffice, for his trials had proved, by that time, that there were, within the varieties themselves, races or " strains " which contained larger or smaller percentages of dry matter, and that these differences were inherent in the races, and were transmitted through the seed to their descendants. Helweg, therefore, devoted his energies to the discovery of the superior races, and, having done so, he published the names and addresses of the vendors of the seed.

The farmers were not slow to use the knowledge obtained for them, and to-day root seed, unless it has come from a race which has been proved 1st class in the comparative trials, is unsaleable in Denmark. No farmer will be deluded into buying seed from roots which merely look pretty and give a high total

* Wood and Berry : *Jour. Agri. Sci.*, Vol. I., Part 2, p. 176. Wood. *Ibid.*, Vol. III., Part 3, p. 225.

yield per acre. "Dry matter per acre" is their criterion, and there is not an agriculturist in Denmark who quarrels with this standard of valuation. Not only has this principle since held its own in the great test of time, but it is gaining supporters daily beyond the confines of Denmark. Sweden has adopted it to the full, and Germany is already deciding in its favour.

And now, the contrast. The British farmer, if he has ever even heard of the Cambridge experiments, has forgotten them. He still continues in the old path of growing for looks and total yield; nor does it trouble him that quite an inordinate amount of that yield consists of water. When will he wake up? It is he, and he alone, who sets the standard, and it is in the nature of things that the seed merchants, as becomes good business men, supply him with what he demands.

In addition to the more obvious benefits resulting from Helweg's work, it has performed another great office; it has done away completely with that tiresome system, particularly prevalent in England, of employing an infinite number of trade names of one and the same variety. The competitions have actually driven out of Denmark all but five named strains of mangolds, and the number of strains of turnips and swedes has been similarly decreased.

Simultaneously with bringing down the number of strains, the work of Fjord and Helweg must be considered to be directly responsible for the amazing increase in acreage under roots in Denmark. This increase speaks for itself when we read that in 1888 it was 95,000 and, as already mentioned, had become 678,000 in 1919, an increase roughly of 600 per cent.

Experts may have different views as to the scientific accuracy of the methods employed in the Danish trials, and as to some of the conclusions drawn from them, but one great cardinal fact remains—they have decisively and completely fulfilled their object, and have set an example which one can only hope will be followed without delay in Great Britain, where there are already many fervent admirers of the patience, persistence and capacity which Helweg has brought to his great task. He is now an old man, but when the writer lately spent an evening with him in Copenhagen, discussing his life work, his enthusiasm was as unabated as his natural powers are undimmed.

For full details of how the work was performed, of the method by which ever-improving races are continually replacing the older ones, and of the large profits obtained by their fortunate producers, Mr. Faber's book must be directly consulted. In it will also be found complete descriptions and histories of the races of mangolds, turnips and swedes now popular in Denmark.

Grasses and Clovers.—As a natural sequel to his description of Helweg's work on roots, Mr. Faber devotes his third chapter to an account of the improvement which has been made in grasses and clovers. The information is less detailed than that contained in the preceding chapters, but contains much which should be read with special care at the present time when we are just discovering what great advantages accrue from the use of indigenous races when laying land down to grass. Mr. Faber starts by describing the work of P. Nielsen on the improvement of pastures, and his researches to find appropriate mixtures for seed leys; but the greatest advance, the improvement of races of grasses and clovers, was the direct result of the adaptation of Helweg's methods to those crops, and was not begun until 1908. In that year the State determined to arrange for comparative cultivations of the above-mentioned crops in order to discover the best races, the standard of comparison being yield of hay. Foreign strains were included in the trials, but here, again, home-grown seed always proved of greater worth. As a result of the interest aroused by these trials, the acreage devoted to grass-seed culture has increased from 10,600 in 1901 to close upon 78,000 in 1919, and Denmark, from being a large importer, has now become an exporter of grass and clover seed. The majority of the seed, both for home and for export, is grown by farmers' co-operative associations, and their seed-cleaning establishment at Roskilde is imposing evidence of the excellence of their organisation.

As an example of the confidence placed in the results of the trials, it may be mentioned that the seed from the best Italian rye-grass strain (Danish grown), in all 12 cwt., was sold in 1912 at the rate of about £450 per ton.

Mr. Faber states that despite the short time that these trials have been running, they "have done away not only with the bad seed, but also with the dishonest and the ignorant seed-merchants; and, with them, have disappeared the florid advertisements of indifferent strains with high-sounding names"—truly a consummation much to be desired by any country.

The Seed Trade.—The last chapter is devoted to "Guarantees in the Trade in Seed." In it we are told something of the development of the Danish Seed Testing Station between the time of its foundation by E. Miller-Holst until the present day, when it is directed with infinite zest and capacity by Dr. Dorph-Petersen. The origin of the Danish system of "automatic control" is recounted, by which seed firms selling two-thirds of the seed used in Denmark have voluntarily bound

themselves to submit to control by the Seed Testing Station all seed sold. They guarantee purity, germination, maximum proportion of weed seed, etc., and, should the tests made by the Station prove that a bulk of seed sold is below guarantee, compensation is automatically paid to all customers who have been supplied with any of this bulk. The author gives a very lucid exposition of the detailed working of this scheme and of the results obtained. Interesting though the scheme is, it does not demand special attention here in England, for, if the new Seed Bill becomes law, the British farmer will be satisfactorily safeguarded in these respects.

The last portion of the chapter, however, shows a unique departure in seed trade practice, namely, the guarantee voluntarily given by the Danish seed merchant that the seed sold by him is of the strain indicated, and that full compensation will be given to the buyer for the smaller yield resulting if it should be found that seed of another and inferior strain has been delivered. This development is the latest result of Helweg's work. It arose as a consequence of the great financial value of seed from strains of roots which had done well in the comparative trials. The reputable seedsmen found that certain of their competitors were unscrupulously selling inferior seed as one of the 1st class strains, thus robbing them of the results of their time and labour, as well as discrediting their wares. They saw at once that only honest traders could give this guarantee, and would have nothing to fear from its effects, whereas unscrupulous or inefficient dealers could not afford to take the risk, and, by refraining from giving the guarantee, would acknowledge themselves to be unreliable, and would in consequence soon be deserted by their customers. This, in effect, has happened, and where at first only root seed was so guaranteed, the practice has now spread to grasses and leguminous seeds used in rotation leys. Mr. Faber does not mention it, but preliminary work is now on foot in Denmark with the object of immediately extending the guarantee of genuineness to cereals also.

Mr. Faber fully explains the method by which the guarantee is checked, to the satisfaction of both trader and farmer.

By this new publication the debt which British farming already owes to Mr. Faber for his previous book, "Co-operation in Danish Agriculture," has been still further increased. Everyone who reads "Forage Crops in Denmark" will put it down—and return to it—with a feeling of intense admiration for Mr. Faber's great little country, not, it may be hoped, unmixed with a resolve to profit by the lessons so ably described.

THE TEMPORARY LEY AND THE IMPROVEMENT OF GRASS LAND.

IN a lecture given at the Bath and West Counties Show under the auspices of the Ministry and as part of the latter's grass-land campaign, Professor R. G. Stapledon, M.A., of the University College of Wales, Aberystwyth, stated that if British agriculture is to be of maximum service to the Nation, and is to give the fullest recompense to the farmer, a proper balance must be maintained between crops and grass. He mentioned, also, that owing to the high price and scarcity of all foodstuffs, this balance will tend more and more in favour of the plough. He felt convinced that while less permanent grass is wanted, what we retain of any and every kind of grass must be every inch of it productive. Our derelict grass lands are our agricultural slums, and to begin all over again with a new system of rotations might prove to be the best method of improvement.

Grass land improvement is largely effected by the use of wild white clover and phosphatic manures, and of productive instead of half productive temporary leys. It is necessary, therefore, that we should have phosphates, white clover and good seed of the proper kinds for leys.

In considering the possibilities of effecting improvement of grass land the following questions should be asked:—(1) Will any field that is to be improved respond quickly to surface treatments? (2) Would it be better to break the sod and begin again? (3) If it is a case of beginning again (a) would it be better to get it down with a permanent mixture as soon as possible, or (b) would it be better to alter the scheme somewhat, taking a rotation plus the four-year ley around the farm, rather than ploughing one corner of a farm and leaving the rest as permanent grass?

The Temporary Ley.—Professor Stapledon dealt first of all with the temporary ley, and pointed out that it is quite certain that this kind of ley will not justify itself unless:—(1) It can be established rapidly and with reasonable certainty; (2) It will be practically uniformly productive over the whole period of four years (in some districts a three- and in others a five- or six-year ley may be more advantageous); (3) It will give per annum as much keep as or more keep than a permanent pasture under the same conditions of soil and climate; (4) It will impart as much fertility to the soil for subsequent arable crops as a broken permanent pasture—possibly more.

The lecturer advised late sowing, and referred to the value of rape as a nurse crop. It is essential to reduce the seeding per acre to the minimum, and with greater attention to the preparation of tilth, the question of nurse crop, depth of sowing, and the precise time and weather conditions under which to sow, the seeding per acre could often be reduced, in some cases perhaps by 50 per cent.

The experience of the lecturer has indicated that it does not matter very much at what time seeds are sown between the middle of May and the end of July or middle of August, provided that they go down on a good clean tilth not too deep, and during a 10- to 14-day spell of warm showery weather.

The Choice of Seeds Mixture.—The first essential in a plant for sward promotion is "late maturity," *i.e.*, late flowering, which is not necessarily correlated with late production of leaves, but only with greater production of leaves. Wild white clover and late-flowering red clover form the bedrock of a good ley. The former gives density, contends against weeds and builds up the fertility. The latter is the red clover for a ley, because it lasts; good strains may last for four years, and others will invariably last for two. The lecturer urged his audience to be more careful about their stocks; to concentrate far more on late-flowering red clover; to build up strains derived from seed long grown in this country and not from imported seed; to take care to grow for seed on a clean field; and to grow specially for seed by sowing in drills and keeping the fields scuffed.

Professor Stapledon stated that he would rather depend on the few species of clovers and grasses that offer certain success than include a large number as a sort of "shot at a venture." In his opinion it would be desirable to purchase wild white clover ($\frac{1}{4}$ lb. per acre is often enough), late-flowering red clover, good cocksfoot, rough-stalked meadow grass and Timothy.

With the help of wild white clover and with careful management one can establish a temporary ley that will savour strongly of the permanent sward. As years go on, a wider selection of valuable strains of herbage plants should certainly be available. The ley, too, will often have the advantage that it will be much less weedy.

Top Dressings.—If phosphatic manures do not produce the desired results, the reason may generally be attributed to one of the following limiting factors:—

(1) *Scarcity of Potash*.—This is sometimes the case on sandy soils or on peats. In the case of meadows the deficiency is much assisted by dressings of farmyard manure. On pastures, mineral phosphates should be applied, but only after the deficiency has been proved as a result of small scale trials.

(2) *Almost complete Absence of leguminous Herbs*.—This may be rectified by renovating mixtures consisting largely of wild white clover. In wet climates, where the turf is dense and bent abounds, it is difficult to get any sort of seed bed for a renovating mixture. On drier and on calcareous soils a sufficient crumbly silt can often be obtained, and renovating mixtures sown in wet weather are often successful.

(3) *Physiological Dryness of the Soil*.—This may be due to a dense matted turf which actually prevents rain properly reaching the soil below. Rough swards should be heavily grazed with ponies and lime applied; improvement can only be slow. It is difficult to improve the swards on very dry sands by surface dressing, as the soil needs abundance of organic matter which requires to be ploughed in.

(4) *Swards full of Weeds*.—These are slow to improve by top dressing, and in order to reduce mat herbs it may even be necessary to apply a mixed dressing, including ammonium sulphate, although under ordinary conditions it is not a sound practice to apply nitrogenous fertilisers to pastures. On a rough turf it is a great advantage to harrow in top dressings with a toothed harrow.

Breaking the Sod.—It is most desirable that the sod should be broken (1) when there is a coarse, matted sward, (2) where leguminous herbs are absent on a dense turf, and (3) on very dry, sandy soils. In the last case soiling crops should be ploughed in, the field sown down with a cheap mixture consisting largely of rib-grass, grazed with sheep, rebroken after two years, soiling crops again ploughed in, and the land finally re-seeded with a good mixture. The need for breaking the sod is indicated even on fairly good fields if full of weeds.

A good case for breaking can, however, often be made for entirely different reasons, namely, where the soils do not carry high-class permanent pastures. There can be no doubt that a grass rotation carried over the whole farm would give far more grass keep, hay and grazing, and more both cleaner and better arable crops than a part of the farm under permanent grass and the rest under rotation with but the one or two-year ley. It was from this point of view that the lecturer wished the question to be considered. Such grass-land farming would,

of course, imply a whole sequence of high-grade leys, some designed more particularly for hay and others more for pasture. This would mean more ploughing out of sward than in the "water-tight compartment" method; but in wet climates it should be a decided gain, for frequently days too bad to plough arable are suitable for breaking sward.

Breaking is, of course, the last resort on the heavy, unworkable clays, and if such fields are broken there would be much to be said for the double summer fallow. If inaccessible fields, or steep, hilly, or badly-shaped fields are best broken, it would be a distinct advantage to get them down to grass again without a second ploughing. On friable soils in wet districts this can be done with every promise of success by the method of rape pasturing advocated some years ago by Mr. Wibberley.*

Proper Grazing.—No matter what method of grass-land improvement is adopted, the maximum benefits can never be obtained unless grazing is properly regulated, and unless also the grazing is heavy in proportion to the amount of keep, that is to say, in proportion to the success of improvements. Speaking very generally, there is far more harm done by under stocking than by over stocking. What is wanted is a sort of rotation system of stocking, store cattle following fattening animals, sheep following stores, rather than competitive mixed grazing. Intensive grass-land management is not compatible with large enclosures; the enclosures need to be varied in size according to the time of the year, the weather conditions and the type of animals grazed.

In conclusion, Professor Stapledon remarked that the temporary high-class ley taken over a farm leaves its legacy in fertility, makes rotations elastic, and surmounts to some extent the difficulties connected with the present shortage of fertilisers. In the present uncertain state of the world's food supplies the nation which can devise a system of agriculture that can be rapidly made subservient to any sudden and unforeseen need, without at the same time disorganising the industry, will have achieved security against shortage. The pivotal crop in a general emergency rotation (and who can say what it will pay the farmer best to grow two or three years hence, or what the nation will most need) is not wheat, nor oats, nor roots, but is the high grade temporary ley.

* See this *Journal*, November, 1914, p. 701.

CHICKENS AND RABBITS: PROFESSOR PUNNETT'S EXPERIMENTS.

THE important experimental work now being carried out at Cambridge by Professor R. C. Punnett, F.R.S., has a vital bearing on the development of the poultry industry. That branch of small live stock keeping is receiving the special attention and care of the Ministry through its Rural Industries Branch, and together with poultry breeding a strong effort is being made to foster rabbit breeding as well. Professor Punnett's experiments, although they are in some respects in their infancy, should add much to our knowledge of scientific breeding.

As far as poultry is concerned, his researches point to certain modifications. It may be well, for example, to breed from coloured strains in preference to all-white, because in the all-white it is impossible to tell the sexes apart on hatching. At the same time, it is true that the all-whites are about the best utility birds *at present*. High laying qualities are transmitted especially by the male, and consequently where laying-strain birds are concerned, cockerels must be kept for store. The flocks of White Leghorns and White Wyandottes are beautiful to look upon in proper surroundings, but their superiority does not arise from any thing inherent in the white that makes for better laying, but because more attention has been paid to it in the way of selecting and breeding from the best laying stock. Professor Punnett holds that were equal attention paid to coloured strains, these might be made just as good. In that case, they would be preferable, because the surplus cockerels could be eliminated on hatching. Silver and gold crosses may be kept with advantage. For example, Professor Punnett recommends the brown Leghorn cock and silver grey Dorking hen, or black Leghorn cock and Plymouth Rock hen, or black Leghorn cock and Cuckoo hen, or Buttercup cock and silver Wyandotte hen. The result of crossing is curious. All the progeny of a gold cock and a silver hen reverse the colours. The cocks are silver and hens golden. Even at birth, and this is an important point, the differences can be seen. Professor Punnett showed this by an illustration in a recent article in this *Journal*.* He advocates the immediate killing of the male birds, so that the trouble and expense of rearing go only to the pullets. Elsewhere he has discussed the superiority of cross-bred pullets over pure strains for general purposes of egg production. By cross-breds he does not mean mongrels, but

* The issue for February, 1919, p. 1319.

first-cross birds from pure strains. The cross-bred is not a better egg-producer; its merit lies in its superior vigour. The losses at hatching and at all stages of life are very much smaller, and this is an important point, because one cannot expect the majority of small raisers to be highly skilled. Even if the cross-bred were a poorer layer, the ultimate advantage would lie with it, because, generally, it does so much better.

In his researches on rabbits, Professor Punnett points to the necessity of getting rid of comparatively unproductive or valueless breeds and concentrating upon the production of fur and flesh. For the first purpose, he advises close consultation with furriers. The quality of the skin results from the presence of various types of hair, and research on Mendelian lines has not yet advanced far enough to provide a structural analysis that will make results sure. There are many qualities of fur. At present we know nothing of the inheritance of fur "quality" as opposed to "colour." "Colour" analysis is fairly complete, although there are still some points to unravel. "Quality" analysis is only beginning. Further points urgently requiring experimental research are *early maturity*, *size of litter* and *time of moult*. At present, Professor Punnett is not investigating any of these, because his plant is not big enough to permit of such experiments. These questions ought, however, to be undertaken as early as possible, so that this country may be in a position to capture its share of the trade in natural rabbit fur, which is going to develop very rapidly, owing to the world shortage of fur generally. "Blues" and "Chocolates" are the best skins on the market, and the result aimed at is an increase of size with a maintenance of quality.

It is clear from Professor Punnett's work that if we are to make the best of our poultry and rabbits, the old methods will suffice no longer. The cost of food and labour has risen so much in the past few years that the expenditure made upon live stock must be such as will produce a commensurate return. Utility stock costs as much to keep and to care for as the most carefully selected strain, but the return from the market is comparatively trifling. Few people realise that if they will take the trouble to study the work that is being done on their behalf by men whose interests are entirely scientific and have no association with commerce, they can learn to turn their hobbies to the best advantage. Many of our best-equipped men of science are now investigating problems of vital interest to the beginner who keeps a few head of stock in his garden, or on his allotment. Will he turn and consider what they have to teach him?

INSECT AND FUNGUS PESTS IN JULY AND AUGUST.

IT is proposed to include periodically in this *Journal* notes on insect and fungus pests which are likely to be troublesome in the month following publication. In most cases the damage done by the pests which are obvious on the various plants at this time of the year cannot be checked, but it is hoped that the notes will help growers and others to recognise the pests attacking their crops so that they may take steps in following years to prevent a similar attack. If growers are uncertain as to the nature of any particular pest or disease, a specimen, carefully packed in a tin box, should be sent to the Ministry, 72, Victoria Street, London, S.W. 1, for identification and advice.

Vegetables.—In most parts of the country *Potato Blight* may be expected to appear about the middle of July; it had already, by the middle of June, appeared in the south-west. Its general appearance is now fairly well known, but for the benefit of those who have not seen its early stages it may be stated that the disease usually appears first in the shape of one or more blackish spots or blotches on the leaflets. On looking at the under surface a similar spot will be found, but this is surrounded by a white or greyish ring of mould. This mould is composed of the fine filaments or threads of the fungus, which have come to the surface of the leaf to produce the spores or "seeds" of the disease, which the wind spreads broadcast. As the disease is internal, little or nothing can be done to check its course in the plant, but its spread to healthy plants should be prevented by spraying with Bordeaux or Burgundy mixture. Copper salts, the poisonous constituent of these mixtures, are very deadly to germinating spores, and, if sprayed on the plant in a neutral (non-acid) form, so that a thin film remains on the leaves, the plant is protected from an external attack. Germinating spores coming into contact with the copper salt are killed and, therefore, unable to enter the leaf.

The question as to whether *Potato Disease* will become epidemic rests very largely with the climatic conditions. In the south-west and in Ireland, where summer conditions are usually warm and damp, spraying of potatoes is absolutely essential if a healthy crop is to be obtained, but in England

generally, apart from the south-west, such conditions only obtain occasionally, and usually for a limited period. Hence farmers and others often take the risk of weather conditions being favourable, and refrain from spraying. In connection with potato spraying it should be noted that severe foliage injury has occurred where potatoes badly attacked by aphides have been sprayed with copper fungicides. Under such conditions, especially in the drier districts, it is perhaps wiser not to spray.

Particulars as to the making of these spraying mixtures and precautions that should be taken are stated in the Ministry's Leaflet No. 23.

Most of the potato diseases will now be in evidence, and growers lifting first earlies may find potatoes with warts or protuberances upon them. This is, most probably, the dreaded *Wart Disease* (Figs. 1 and 2), which, if present, should be at once notified to the Ministry or to the local police. The appearance of the disease is unmistakable (see Leaflet 105), although sometimes a bad attack of "ordinary scab" is liable to be confused with it. This "ordinary scab" is merely a surface disease, and has little effect on the crop beyond spoiling its appearance.

Leaf Curl is another disease which very seriously reduces the yield of the potato crop. Curled plants may be recognised by their dwarf appearance and the fact that the lower leaves are markedly curled. The produce of such plants is always below the normal, and in bad cases the crop is almost nil. The tubers from these plants, being of small size and of normal appearance, are apt to be set aside for "seed." To do this, however, is a great mistake, as tubers from curled plants yield a curled crop again, with an increasingly low yield. If home-saved seed is required the healthiest plants should always be selected for "seed," and if curl is at all prevalent, no "seed" should be saved from the plot. In dry and southern districts fresh northern seed should be obtained each year. (See new edition of Leaflet No. 164, and article in the issue of this *Journal* for last month, p. 287.)

Pests on other vegetables will be plentiful and the various caterpillars of the Cabbage Butterflies and Cabbage Moth will be attacking the *Brassicas*. In gardens and small plots much can be done when the butterflies are noticed by turning over the leaves and crushing between the thumb and finger of the gloved hand any batches of eggs which may be seen, or, if the eggs have hatched, by noting the small



FIG. 1.—Tuber of Arran Chief, showing Wart Disease.

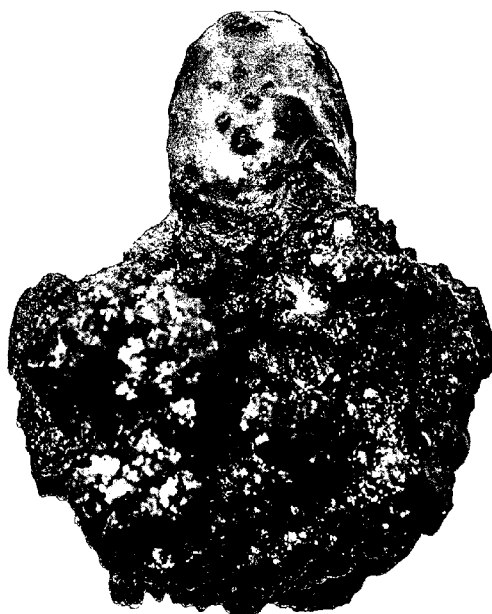


FIG. 2.—Tuber badly attacked by Wart Disease and commencing to decompose.

holes which the young larvae have eaten, and destroying the larvae before they have scattered. (See Leaflet No. 109.)

On celery, the damage done both by the *Celery Fly* and the "*Celery Blight*" may be found. It is somewhat late to begin treatment, but some steps may still be taken. If the attack of "*Fly*," which causes blisters on the leaves, is slight, the larvae may be pinched between thumb and finger or the leaves pulled off. This will go far to prevent damage later in the season. In the case of the *Blight*, which is caused by a fungus, spraying with Bordeaux mixture may prevent further spread of the disease, but another season this should be put on much earlier, while efforts should be made to obtain seed which is guaranteed free from the spores of the fungus causing this disease. (See Leaflet No. 238.) Prevention in the case of the *Celery Fly* consists in spraying with a strong smelling wash, such as a paraffin emulsion, which will mask the odour of the celery and therefore prevent the fly from being attracted to it to lay her eggs. This method should be noted in connection with flies which attack other vegetables, such as the *Carrot Fly*, *Cabbage Fly*, *Onion Fly*, etc. These can seldom be destroyed once they have attacked the host, but may be prevented from laying their eggs by a method similar to that suggested above, although in the case of these insects, ashes or sawdust damped with paraffin may be used to sprinkle at the base of the plant.

Fruit.—In some plantations and gardens a further brood of *Gooseberry Saw-Fly* larvae will now be in evidence. Here, again, hand-picking in gardens is most effective if it is done while the larvae are still young, for then they are largely confined to a few leaves, which are indicated by a large number of small holes where they are feeding, and the removal of such a leaf will mean the destruction of 20 to 30 caterpillars. Very small caterpillars may be destroyed by a carbolic soap solution, while, since all the berries will have been picked, the pest may easily be dealt with by means of a poisonous wash. (See Leaflet No. 12.)

Brown Rot on plums will also be manifest by the rotting and the frequent massing together of two or three fruits. These plums, either now or later, produce concentric rings of spores, and may either fall off or, more frequently, remain on the trees and dry up. Little can be done at this season beyond removal and destruction of the dressed fruit; if such fruit is left on the tree it dries up and remains for the winter, only to produce a fresh crop of spores, and so reinfect the young growth in the following season. Apples may also be found affected:

by this disease, and the same remarks apply to this fruit. Occasionally, instead of the apple rotting and producing its concentric layers of spores, it becomes dark and purple in colour and then dries up. Such fruit, which is usually found amongst stored apples, will, however, produce spores later when conditions are favourable.

Where *Codling Moth* is present, as will be noted by apples falling prematurely and being found "maggoty," the windfalls should be collected or pigs turned in where possible. Haybands should be placed around the trees so that the caterpillars, which are pinkish in colour, may pupate beneath their shelter. Later in the season the whole may be burned. (See Leaflet No. 30.)

Cereals.—Farmers will now find the *Smuts* and *Bunts* showing on their corn, and nothing can be done to check these diseases this season. Every effort should be made, however, to prevent wastage of good corn by such parasites next year. *Bunt* in wheat, *Smut* in oats, and *Stripe* in barley can be controlled by "steeping" the seed. For this purpose the Ministry recommends formalin or copper sulphate (blue vitriol). These substances are by far the most efficient steeping solutions, and should be used in preference to other substances of doubtful value. (See Leaflets Nos. 92 and 328.)

Wheat Bulb Fly has been very destructive to winter wheat this season, and has occurred especially on wheat after bare fallow. Evidence is accumulating to show that the pest is always most serious on land which has been fallow or only partially covered by such crops as potatoes during the latter half of the summer. In the case of fallows, at all events, it is very probable that the trouble may be avoided by sowing such a crop as mustard after the land has been cleaned. The mustard is ploughed in previous to the wheat being sown, and is, of course, a valuable preparation, quite apart from its probable effects against the Wheat Bulb Fly.

THE INJURIOUS APPLE CAPSID

(*Plesiocoris rugicollis*, Fall.).

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It has long been known that there are several species of bugs belonging to the family Capsidæ which live upon apple trees. These insects feed by means of their long trunks, which they push down into the tissue of leaf and fruit and use also for sucking up the sap. Until recent years the damage resulting from this feeding has been attributed indiscriminately to any of the four or five apple-feeding species, but of late Fryer (1) and Petherbridge (2) have discovered that the damage is due to only one species, a green bug, *Plesiocoris rugicollis* by name. This has been confirmed by the writer in recent experiments.

Nature of Damage.—This bug seems to have increased greatly of late years, and has caused serious losses to apple growers, particularly in Cambridgeshire and the Wisbech district. The damage caused by the insect consists of a stunting* of the leaves and shoots, serious malformation of the fruit, and, after consecutive attack for several years, a stunting of the tree itself. In the case of the leaf, wherever *P. rugicollis* inserts its rostrum and sucks the sap, there appears a red spot which may spread somewhat and which represents an area of dead cells. The young leaves and shoots are generally chosen, and in a severe attack the young foliage is almost entirely covered with these red spots, and in many cases growth ceases and the shoots are killed. As the young apples appear the capsids transfer their attentions to this fruit, and the apples in their turn become covered with the characteristic red spots. The only difference in this case is that the damage develops further, a corky scab is formed, growth of the apple ceases, and frequently the fruit falls to the ground. In cases where only one side of an apple is punctured, the undamaged side continues to grow, and a badly distorted and unmarketable fruit is the result. In bad cases of capsid attack the damage to the fruit is very similar to, and sometimes mistaken for, the fungal disease, apple scab. The object of the work here described in brief was to ascertain the nature of the damage and the reason that only one species produced it.

Experiments as to the Cause of Damage.—There are three possible explanations of this damage—(1) a purely mechanical

laceration of the tissue by the mouthparts of the bug in the process of feeding; (2) the introduction into the plant of bacteria along with the salivary juices, which then set up a disease; (3) the introduction into the plant of some chemical substance or enzyme, which causes a reaction with the juices of the plant. A number of experiments were performed to ascertain which of these theories was the correct one.*

The results of these experiments proved conclusively that the damage was caused by some chemical substance or enzyme in the salivary juices of *Plesiocoris rugicollis* peculiar to this species among those bugs normally feeding on apple. This chemical substance or enzyme is injected into the juices of the apple along with the secretion from the salivary glands, and sets up the violent reaction above described.

Lygus Pabulinus.—There is another green bug of the same family, and closely allied to *P. rugicollis*, namely, *Lygus pabulinus*, which normally feeds upon herbaceous plants, as for instance, potatoes, and the injury it produces affords a parallel case to that caused by *P. rugicollis* on the apple. Although *L. pabulinus* feeds upon potato during the summer, in the early part of the year it lives upon red currant and gooseberry, from whence it migrates to the potato, and in late autumn turns its attention to the artichoke. The writer has found it upon red currant, black currant, gooseberry, pear, potato, bindweed, dock, plum, among other plants, and under experimental conditions has reared it to adult life from the first stage (or instar) upon apple and willow, the two food plants of *Plesiocoris rugicollis*. These facts are mentioned in order to show the danger to be apprehended from this family, consequent upon the changing of the host plant. The reasons for these changes of food plants are not known, but it would be well to recognise the possibility of capsids such as *Lygus* and its allies suddenly developing a taste for fruitarian diet.

Further information as to the life history and control of the Apple Capsid is given in the Ministry's Leaflet No. 319. The following methods of control of this insect are recommended in the leaflet:—

Methods of Control.—Apple Capsids are difficult insects to control, but the damage can be greatly reduced by careful spraying. The work, however, must be well done, for it is necessary to wet each bug with the spray fluid—not an easy matter when they are sheltering between the flower buds in the trusses or among

* For a detailed account of these experiments, see the writer's paper in the *Annals of Applied Biology* of this year.

the developing leaves. Further, a very few bugs are capable of doing great injury, and therefore the majority of the insects must be killed if real benefit is to be gained. A fairly coarse nozzle should be used so as to get a driving spray, which should be directed first downwards into the trusses and leaves of a branch passing from the tip to the trunk, and then back again to the tip after turning the nozzle upwards, so as to catch bugs sheltering underneath the leaves.

The best time to spray varies with the season, but it is generally during the week or ten days immediately preceding the bursting of the blossom. A watch should be kept for the first signs of spotting of the leaves—then, after an interval of ten days to allow the majority of the bugs to hatch, the spray should be applied. Much good can be done by one spraying, but in a badly affected orchard, especially if a good crop is anticipated, it is better to spray again immediately after the petals have fallen.

The best insecticide to use is nicotine, which should always be combined with soap or paraffin emulsion to assist it to run freely in the trusses and between the young leaves. The following formula has proved satisfactory:—

Nicotine (98-99 per cent.)	..	..	..	3 oz.
Soft soap	..	..	..	4 lb.
Water	..	..	..	40 gal.

This wash is, of course, expensive, but it is waste of labour and time to spray against Capsids with a wash which is not highly efficient. Further, nicotine and soap will kill aphides, apple suckers, and a good proportion of any winter moth caterpillars which may be present, and it is therefore a good "general purpose" spray.

References.—(1) Fryer, J. C. F.—Preliminary Notes on Damage to Apples by Capsid Bugs. *Annals of Applied Biology*, Vol. I., No. 2, July, 1914.

(2) Petherbridge & Husain.—A Study of the Capsid Bug found on Apple Trees. *Annals of Applied Biology*, Vol. IV., No. 21, March, 1918.

THE GREAT EASTERN RAILWAY DEMONSTRATION TRAIN.

THE Great Eastern Railway Company have recently shown great enterprise in arranging for a Demonstration Train to be run over their railway with the object of instructing growers and allotment holders in the Eastern Counties of England in up-to-date methods of production of crops, poultry and small live stock. This is not the first enterprise of the kind undertaken by the Company; a train was equipped some years ago for the purpose of stimulating egg production in the district served by the Railway. The results of this earlier experiment were such as, in the opinion of the Company, would justify the cost of the undertaking, and they therefore decided to run a second train containing exhibits which would include, in addition, the subjects of horticulture and live stock.

Training and Itinerary.—The Train consisted of three converted hospital coaches, a restaurant car and a van. It started from Liverpool Street Station on 17th May, after an official opening by the Parliamentary Secretary of the Ministry, Sir Arthur Griffith Boscawen, M.P., and ended its journeyings at the same station during the first week in July. The itinerary of the train included Essex, Suffolk, Norfolk, Cambridgeshire, Huntingdonshire and Lincolnshire. Forty stations were visited, and the general rule was for the train to be in its place and ready for inspection by visitors at 1 p.m. on the date fixed, and to be open until 8.30 p.m. During this period a constant stream of visitors passed through it, examining the items on view. It is estimated that up to the 14th June, 77,500 persons had visited the train.

The success of the Train was assured from the first, as is well testified by the large numbers of people who took the opportunity of visiting it. The Train as a whole was in charge of officials of the Great Eastern Railway Company, who made all arrangements.

One of the cars was placed by the Company at the disposal of the Ministry for the purpose of placing on view exhibits bearing on horticulture, fruit preserving and dairy produce. This car was staffed by officials of the Ministry.



FIG. 1.—Exterior of Train at Stratford Station.



FIG. 2.—Portion of Poultry Section Exhibit.

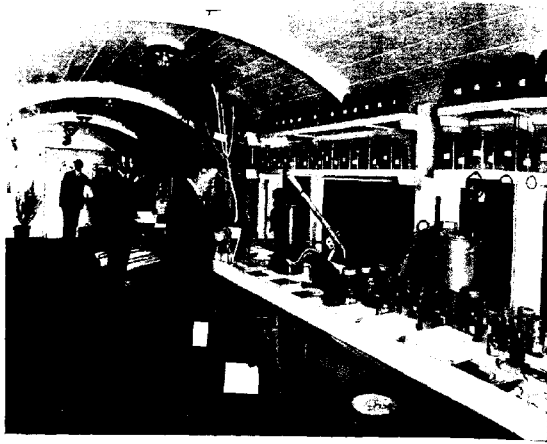


FIG. 3.—Horticultural Car—Fruit Bottling and Canning Section.



FIG. 4.—Horticulture—Pests and Spraying Section.

The Staff.—All the demonstrators on the Train were carefully selected as practical men with experience in dealing with their subjects. Mr. J. N. Leigh, the poultry expert of the Great Eastern Railway Company, was present to give advice on poultry, and he was assisted by Mr. Tom Barron and others.

As regards horticulture, the Ministry placed at the disposal of the Railway Company Mr. Vincent Banks, whose work in dealing with the preservation and bottling of fruits and vegetables is so widely known throughout the country. His demonstrations were thoroughly appreciated by all visitors interested in horticulture. Mr. Jenkins advised small cultivators on the growing of garden and allotment crops, fruit culture, the management of bees, and bee-keeping. Mr. C. H. Middleton advised fruit growers on matters relating to fruit culture, including measures for the control of pests. These experts travelled with the Train to explain the exhibits, answer questions, and give advice generally. The subjects treated were soil working on small holdings and allotments, liming, manuring, fruit and vegetable growing, insects, and small live stock.

The Exhibits.—The Ministry's exhibits may be divided into four sections, representing (1) Fruit and Allotment Culture (including a small Bee Exhibit, (2) Plant Diseases, (3) Fruit and Vegetable Preservation, and (4) Dairying.

(1) *Fruit and Allotment Cultivation and Bee-keeping.*—Fruit growers showed great interest in the specimen fruit trees (growing in pots) which were employed to demonstrate the best methods of grafting and pruning. The specimens were supplemented by photographs of large trees showing the ultimate benefits accruing from such methods. Attention was directed to the suitability of the bush type of tree for cottagers and small growers. Allotment holders were provided with photographs, charts, and descriptive diagrams of model allotments, and examples of the best tools and implements for their use were exhibited.

The great interest now taken in bee-keeping was shown by the numerous inquiries on this subject, and numbers of people appear to wish to make a start in bee-keeping.

(2) *Plant Diseases.*—Allotment holders and fruit growers had a common interest in the Plant Disease Exhibit, and even the casual passer-by was attracted by both specimens of the many pests of the farm and garden. The various methods of attacking these pests were illustrated by diagrams

and explained in leaflets, while samples of washes and spraying machines and specimens of such natural enemies to the pests as the ladybird were also shown.

Inquiries concerning many of the common pests were numerous, and in many cases specimens were brought for identification and advice. Special interest was aroused by the specimens of potatoes infected with Wart Disease. This disease, extremely common in the western and northern districts is rare in the eastern counties, and growers were glad of the opportunity afforded of seeing examples, which would enable them to recognise the disease should it appear in their gardens. It may be mentioned, however, that every effort is being made by the Ministry to keep these counties clear of the pest. Another disease which has recently been made the subject of an Order of the Ministry is a new disease of onions, called Onion Smut, and the specimens of onions infected with this disease were also on view.

(3) *Fruit and Vegetable Preserving*.—Perhaps the most striking exhibit in this car was the display of bottled fruits and vegetables, containing produce which in some cases had been preserved by simple methods for several years, and was still in excellent condition. The apparatus shown included various types of bottles, cans, ovens and sterilisers, and frequent demonstrations were given in their use. Simple methods of fruit and vegetable drying, methods of canning, and the preservation of stone fruit by means of sulphur fumes, were also shown. Visitors were frequently surprised at the easy nature of these operations and the simplicity of the apparatus required, and there is no doubt that as a result of these demonstrations fruit which might otherwise have been wasted owing to the scarcity of sugar this season will now be preserved.

(4) *Dairying*.—The dairy expert gave practical demonstrations in cheese-making. All kinds of small cheeses were made from time to time; and the demonstrator showed that the quick production of a small cheese was a good way of using up a quart of milk. Larger cheeses were also made as opportunity offered.

(5) *Poultry and Small Live Stock*.—The poultry section pleased a large section of the visitors, and there were always large numbers to listen to the 10-minute lectures on the various subjects, including a lecture on "How to choose a hen for laying purposes." The aim was to bring to the notice of the small poultry keeper the best breeds and the best system of feeding to improve the standard of egg production.

Although rabbits are not now kept to the same large extent as during the War, there are still many people interested in rabbit keeping, and the different breeds and specimens of skins made up into various kinds of fur were represented on the Train. The possibilities of rearing Chinchilla, Havana, Blue Beveren, and other breeds for their pelts was pointed out. The demonstrators gave the fullest information, not only as to the best means of starting rabbit keeping but also of disposing of the produce.

From time to time there has been much controversy as to the value of goats. Advocates of the keeping of the "poor man's cow" have been many, and those interested had the opportunity of listening to lectures on goats and their value. Two goats were carried on the Train in order to enable the lecturer to demonstrate his points in a practical manner.

REDEMPTION OF TITHE RENTCHARGE :

THE TITHE ACT, 1918—INCOME TAX LIABILITY OF LANDOWNER AND TITHEOWNER.

(1) **Introduction.**—Leaflet No. 329 issued by the Ministry detailed the procedure for the redemption of tithe rentcharge under the provisions of the Tithe Act, 1918. A redemption of tithe rentcharge will, however, generally entail modifications of the Income Tax liability of both the titheowner and the landowner who has redeemed the rentcharge, and this supplemental leaflet, which has been prepared in conjunction with the Commissioners of Inland Revenue, is intended to explain the modifications that will be necessary.

(2) **The Present Method of Assessing Tithe Rentcharge to Income Tax.**—(a) The usual practice is for the owner of a number of tithe rentcharges arising out of property in any one parish to return them all for assessment upon himself in one sum.

(b) In the exceptional cases, however, where the titheowner does *not* make a return for the assessment of the tithe rentcharge upon himself for the payment of Income Tax, the land out of which the tithe arises is assessed inclusive of the tithe (as explained in paragraph 3 (b)), and the landowner deducts Income Tax from the tithe as and when he pays it to the titheowner.

(3) **Tithe Rentcharge as affecting the Landowner.**—(a) Where the landowner pays out of the rent received for a particular property a tithe rentcharge to a titheowner who returns the same for direct assessment, as explained in paragraph 2 (a), a deduction in respect of the tithe rentcharge is made from the rent when assessing the property to Income Tax under Schedule A. Thus, if the landowner in such a case lets a farm for a rent of £200 per annum, and out of the rent pays a tithe rentcharge of £20 per annum, he would be assessed upon £180 only.

(b) If, however, the titheowner were *not* directly assessed for the tithe rentcharge, the landowner would be assessed upon the full rent, £200; but as he would have the right to deduct tax from the tithe, £20, upon payment—as explained in paragraph 2 (b)—he would ultimately bear tax upon £180 only.

(4) *Effects of Redemption of Tithe Rentcharge upon Income Tax Liability.*—Leaflet No. 329 sets out the two alternative methods of redeeming a tithe rentcharge, viz., (I.) by payment of a lump sum, and (II.) by payment of an annuity.

I.—*Redemption by payment of a lump sum.*—If the titheowner has been assessed directly in respect of his tithe rentcharge, his position after the redemption will be that his income from this particular source has diminished. He will, therefore, be entitled to a proportionate reduction of the total gross assessment upon his tithes, subject to a proportionate reduction also of the deduction allowed from such assessment in respect of rates, land tax and cost of collection. The landowner, on the other hand, will after the redemption no longer be under the necessity of paying the tithe rentcharge redeemed. He has, however, previously received for assessment purposes a deduction in respect of this tithe (*vide* paragraph 3 (a)), and such deduction will now fall to be withdrawn.

If the titheowner has *not* been directly assessed for the tithe rentcharge, the effect of a redemption will be merely to diminish the amount of income which he receives under deduction of tax (*vide* paragraph 2 (b)). The landowner being no longer under obligation to pay tithe rentcharge out of his rent will, in future, himself bear the tax which he formerly recovered from the titheowner (*vide* paragraph 3 (b)).

II.—*Redemption by payment of an annuity.*—Where redemption is effected by payment of an annuity, the titheowner, if assessed directly for the tithe rentcharge, will be entitled to apply for a reduction of his total assessment for tithe as explained under (I.) above. Such portion of the annuity as represents interest upon the consideration money will be received under deduction of tax, but tax will not be payable on the residue of the annuity. As regards the landowner, inasmuch as he will be relieved of any further payment of tithe rentcharge he will no longer be entitled to the deduction hitherto allowed him, as explained in paragraph 3 (a) above. He should, however, *clearly understand that he is entitled to deduct Income Tax from such portion of the annuity as represents interest upon the consideration money* (*vide* Leaflet No. 329, paragraph 6).

If the titheowner has *not* been directly assessed for the tithe rentcharge, he will after the redemption be receiving interest upon the consideration money, taxed by deduction, in place of tithe rentcharge taxed by deduction. The landowner, on the other hand, will be paying interest from which he is

entitled to deduct tax upon payment, in place of a tithe rentcharge from which he was similarly entitled to deduct tax.

Any titheowner or landowner who desires further information respecting the effect of redemption of tithe rentcharge upon Income Tax Liability, or who desires an amendment of an Income Tax assessment in consequence of such a redemption, should communicate with H.M. Inspector of Taxes for the District embracing the parish in which the property out of which the tithe rentcharge issues is situated. The address of H.M. Inspector of Taxes can be readily ascertained from the local Collector of Taxes. Inquiries relative to the provisions of the Tithe Act, 1918, itself, or to the method of redeeming a tithe rentcharge, must not be addressed to H.M. Inspector of Taxes, but to the Ministry of Agriculture and Fisheries, 3, St. James's Square, London, S.W. 1.

(Copies of this Article in the form of Leaflet No. 348 may be obtained gratis and post free on application to the Ministry.)

* * * * *

AGRICULTURE ABROAD.

AN event probably of some significance in augmenting the friendship between two already friendly nations was asso-

**Horticulture and
International
Friendship: The
British Exhibit at
Antwerp.**

ciated with the recent Horticultural Exhibition at Antwerp. The British exhibit, arranged and carried out at short notice, was at once beautiful and striking, and the circumstances attending the inception and execution of this scheme are of peculiar interest to horticulture. At the request of the Belgian Foreign Office the Ministry of Agriculture invited the British Chamber of Commerce to organise a collective display of British-grown fruit and flowers for the Antwerp Exhibition. The Chamber immediately agreed and sent a representative over to Antwerp to interview the Exhibition Committee and obtain particulars. The result of his inquiries was that the Chamber took over the entire space of the Central Hall, an area measuring 135 ft. by 35 ft.

On the Thursday and Friday immediately before the opening eight members of the British Chamber went over to Belgium with two truckloads of cut flowers, orchids on roots, fruit and plants. During Friday, Friday night and Saturday morning the representatives worked at high pressure arranging their specimens in the form of a garden and turfing over the remainder of the allotted space. They produced an exhibit that was generally acknowledged to be an example of taste and beauty, apart from any question of the excellence of the specimens shown. On the Sunday H.M. King Albert opened the Exhibition and began his tour of the Hall by spending nearly forty minutes with the British representatives. The King asked many questions about cultivation, the area of nurseries, the position of British labour, and kindred topics. He laid special stress on the thanks that were due to British horticulturists for the exhibit, and more than once expressed his opinion that it was calculated to improve the relations between the two countries.

The representatives of the British Chamber were asked to assist in judging the foreign exhibits. It goes without saying that they took no part in awarding prizes to British competitors. The collective British exhibit received from the Belgian judges the highest possible award, and two other highest awards went to individual sections. The President specially commended the quality and excellence of the British flowers, the style and arrangement, and the assistance which British horticulturists had lent to the whole Exhibition. On the

evening of the opening day the Chairman of the British Chamber of Horticulture (Mr. Munro), in return for Belgian hospitality, invited the officials to dinner. The Belgians treated the matter as an official affair, as the British exhibit had been made at the request of a Ministry. Among those present were General Cabra, the Governor of the Province of Antwerp, the Burgomaster of the City, and some thirty of the higher Government and Municipal officials. The General, the Governor, the Burgomaster and many others made speeches dwelling on the importance of the British horticulturists' visit and its effect in drawing the two countries closer together.

The following morning the British Consul, acting under the instructions of our Ambassador, called on Mr. Munro and expressed similar sentiments.

Next autumn it is proposed to arrange a similar exhibit. The whole Exhibition was designed to form a garden scene, to which the British contribution lent the most charming touch. About 10,000 carnation blooms were displayed in vases and stands and grouped in beds set in a grass lawn. Two corner beds were filled with carnations and orchids. Choice roses—Richmond, Alberta, Madame Abel Chatenay and Molley Sharman Crawford—were shown in huge baskets, each group forming a distinct feature. In the central beds heaths and marguerites were set out, and in others were baskets filled with cucumbers, tomatoes, melons, apples, figs, peas and beans. The Belgian exhibits contained collections of Indian and Mollis azaleas, rhododendrons, orchids, araucarias, acacias, and other plants. A notable feature was the exhibit of giant palms and bay trees, which gave the whole Exhibition a sub-tropical effect. There were also several wonderful examples of landscape gardens. The whole undertaking was not only stimulating to horticulture, but was a factor in demonstrating international concord. The fashion here inaugurated is likely to be continued with valuable results during the whole series of flower shows, which will form the main features of the Antwerp fêtes from now until the end of October.

* * * * *

It appears from a note published in the issue of the *International Review of Agricultural Economics* for April last that certain railway companies have given valuable assistance in promoting the development of agriculture in France. Their activities have consisted mainly in the distribution of seed and plants, introducing new varieties, and holding competitions with a

**Railway Companies
and Agricultural
Production in
France.**

view to encouraging the more extended use of agricultural machinery and fertilisers.

Their efforts, however, have not been confined only to the technical side of agriculture. Much has apparently also been done, no doubt with a business eye, for promoting the commercial side of the industry. Parties consisting of agents of the railway companies and of specially qualified farmers were arranged to visit certain areas, both in France and other countries, for the purpose of studying the state of the markets with reference to such produce as corn and root crops, live stock, early vegetables and flowers. Reports were then drawn up, for the information of the farmers of the home districts, describing the conditions prevailing in the areas visited. These reports, it was hoped, would be of assistance to farmers in directing them in the cultivation of crops which would be likely to be most profitable. Further, the agents and inspectors of the companies' commercial departments made individual inquiries or were delegated to make investigations as to the fluctuations of the markets over periods of several months. Large numbers of pamphlets were circulated among farmers, giving information which would help to direct them in their operations.

A further action on the part of the railway companies to improve the facilities for the distribution of agricultural produce was the formation of producing and selling co-operative societies. By this means isolated farmers in the more remote country districts were enabled to get into direct touch with French and foreign consumers.

* * * * *

ACCORDING to a note published in the issue of the *Board of Trade Journal* for the 20th May last, a South African

**Cattle Breeders'
Association in
South Africa.**

Cattle Breeders' Association is to be organised as the result of a resolution passed recently at a representative meeting of South African cattle breeders in Johannesburg. Under the terms of the resolution, the Association is to frame and observe a uniform policy in the handling, marketing, and exporting of cattle and their products, and generally to do all that may be necessary for the protection of cattle breeders, for the expansion of the cattle-raising industry to their advantage and profit, and in the interests of the consuming public.

South African breeders feel that there is an opportunity at the present time to raise the quality of South African beef in the world markets. Organisation is considered to be

necessary to improve the present strain. It will then be possible to establish in South Africa the nucleus of an industry which may take a leading place in international trade.

* * * * *

ONE of the problems which requires to be settled in Northern France is the replacement of the live stock which has been

**Live Stock for
Devastated Areas
in France.**

destroyed by the ravages of the late War. It was stated in a note in the issue of the *Journal d'Agriculture Pratique* for 22nd April last that, in accordance with the terms of the Peace Treaty, the devastated areas of France are to receive from Germany 500 stallions, 30,000 horses or mares, 2,000 bulls, 90,000 milch cows, 1,000 rams, 100,000 sheep, and 10,000 goats. Convoys of this stock have been arriving since the second week of March, and by the 1st of April, 1,400 horses, 4,000 cattle, 10,000 sheep and 4,000 goats had been delivered. Although, according to the note, the agriculturists of the liberated areas had so far been quite satisfied with the quality of the stock received, there was some anxiety felt as to the state of their health on account of the prevalence in Germany of foot-and-mouth disease. In view of the prevalence of this disease in France as well, however, it was considered by the authorities concerned that no more danger was incurred by receiving the German cattle than by buying stock at the local fairs and markets. Moreover, the financial loss which might be entailed by outbreaks of the disease in the imported cattle was probably much less than would result if the importation of German cattle was discontinued.

* * * * *

ACCORDING to information recently communicated to the Ministry from America, experiments have been conducted

**Mineral Matter
and Milk.**

by the Bureau of Animal Industry and the Department of Agriculture of the United States Government with dairy cows, which indicate an important relation between milk secretions and certain mineral substances. The results suggest that feeding compounds of phosphorus and calcium have a decidedly beneficial effect on the milk flow, both in quantity and fat content.

It has also been found that a deficiency of phosphorus in the dairy rations has a detrimental effect on milk secretions of cows and on the growth of calves. This deficiency was successfully remedied, however, by the addition of sodium phosphate to the rations.

NOTICES OF BOOKS.

Journal of the British Dairy Farmers' Association. Vol. 32 (London : McCorquodale & Co., Ltd., 1920, 3s.)—This publication, which reappears after an interval of three years, contains several valuable articles, of which two in particular are of special interest at the present time. In a critical discussion on "Some Effects of the War on the Dairying Industry," Mr. Primrose McConnell, B.Sc., F.G.S., examines the present difficult position of dairy farmers in this country. While offering several helpful suggestions, he sees little prospect of a general improvement without a complete change in the present unsympathetic attitude of the community towards the industry. Supplementing this article to some extent is a careful study of dairy farming in Switzerland, the result of a three months' visit to that country last year by Mr. James Long. In suggesting several features of the Swiss system which might usefully be adopted in this country, he emphasises especially the Swiss practice of using upland pastures for grazing purposes.

Among other contents is a full record of the Dairy Show, which was revived last year after an interval of several years necessitated by the War. Special reports are given on the milking trials and butter tests at the Show.

Gloucestershire Cattle Society.—Report and Herd Book, 1919 (Gloucester : Crypt House Press). This is the first annual report of the newly-formed Gloucestershire Cattle Society, which has for its object the improvement of the Gloucestershire breed of cattle. During the past century the breed had become almost extinct, but the Society confidently expects that the fine specimens which still remain will form the nucleus of herds that will be known all over the world. Fourteen herds have been visited, and 130 animals registered in the Herd Book, 14 being bulls and 116 cows.

The following are indicated as the points (primary and secondary) of the Gloucestershire Breed of Cattle :—

Primary.

- Body, black brown.
- Head and legs, black.
- Dark muzzle and dark roof of mouth and top of tongue.
- Cow's horn, fine with black tip, wide and inclined to turn up.
- White tail, long hair or brushy.
- White streak on back.
- Thin yellow skin with fine short hair.
- White belly.
- Black or spotted teats.
- Broad forehead, long and Roman nose.

Secondary.

- Thin neck.
- Ears large and hairy.
- Shoulders fine.

The Society encourages milk recording—a practice that the Ministry of Agriculture recommends should be done by every dairy.

QUESTIONS IN PARLIAMENT.

Foot-and-Mouth Disease.—In reply to a question by Captain Coote, the Parliamentary Secretary to the Ministry stated that the Ministry was aware that in a few cases individuals would prefer to run the risks involved by an outbreak of foot-and-mouth disease rather than have their stock slaughtered, but the general opinion of agriculturists was strongly on the side of the policy of stamping out adopted by the Ministry, as may be seen from the Report of the Departmental Committee on the subject in 1912. The disease was not directly dangerous to the public health, and, as a rule, horned stock would recover from it; but the disease was highly contagious, and any widespread outbreak might have a serious effect upon milk production. In certain cases where the circumstances were favourable the Ministry had successfully carried out a policy of isolation, but such a method was rarely applicable because of the lack of suitable accommodation on the ordinary farm, and would not be effective as a general policy. As a rule, an outbreak was detected at an early stage, and it was more economical for the industry as a whole to proceed to slaughter than to attempt a system of isolation, especially in view of the fact that the export of pedigree stock to foreign countries, which was a very valuable trade, was seriously hampered so long as foot-and-mouth disease existed in this country. The policy of the Ministry had been completely successful in checking the spread of the disease in the numerous outbreaks that had occurred of late, and had earned for the Ministry the thanks of the farmers in the districts affected. (28th June, 1920.)

Pig-Keeping.—In reply to a question by Sir Beville Stanier, the Parliamentary Secretary to the Ministry stated that the Ministry of Agriculture and Fisheries Act, 1919. (Section 8, Sub-section 4) provided that County Agricultural Committees should make such inquiries as they considered desirable with a view to formulating schemes for the development of rural industries and social life in rural places. The Ministry had formed a Rural Industries Branch under the direction of Sir John Green. Active steps were being taken to encourage and to revive the keeping of pigs and other small live stock among cottagers, and no less than 123 mutual clubs or societies for the purpose had already been formed. The question of insurance of live stock by cottagers had been investigated, and rules for the mutual insurance of pigs and cows had been printed and circulated. Grants from the Development Fund had been given to the Federation of Women's Institutes and to the Village Clubs Association for the purpose of assisting the establishment of women's institutes and village clubs. (28th June, 1920.)

Wheat Prices.—In reply to a question by Mr. McNeill, the Parliamentary Secretary to the Ministry stated that the figure of 68s. per qr. for wheat was the amount which in the opinion of the Royal Commission on Agriculture represented the average bare cost of production in 1919, including interest on capital or remuneration to the farmer himself. The Commission in its report stated that it arrived at this

figure after considering a large body of evidence as to the actual cost of production in 1918, and then applying to its estimate of the average cost in that year the increase which the evidence indicated to have taken place between 1918 and 1919, disregarding any variation in rent. The Report of the Commission did not give detailed figures distinguishing the various items in the cost of production, such as labour, but it referred to the fact that wages had advanced in most parts of the country beyond the minimum rate of 36s. 6d., and that the hours in respect of which the minimum rates were payable had been reduced. (10th June, 1920.)

In reply to a question by Mr. Lane-Fox, the Parliamentary Secretary to the Ministry stated that the average (c.i.f.) price of wheat imported into this country has been as follows :—

	s.		d.		
1917	91	6	per	480	lb.
1918	100	10	.. .. .	
1919	92	1	.. .. .	
1920 (Jan.—May) ..	95	0	.. .. .	

The corresponding price for 1916 cannot be given, as control did not commence until 11th October, 1916.

The price of British wheat was subject to no control until 16th April, 1917, when a maximum price of 78s. per qr. of 480 lb. was fixed for wheat harvested in 1916. On 14th August, 1917, the following maximum prices were fixed for wheat harvested in 1917 :—

Where delivery was to be made before 1st December, 1917, 73s. 6d. per qr. of 504 lb. (70s. per 480 lb.).

Where delivery was to be made in December, 1917, or January, 1918, 74s. 6d. per qr. of 504 lb. (70s. 11d. per 480 lb.).

Where delivery was to be made in February or March, 1918, 75s. 6d. per qr. of 504 lb. (71s. 11d. per 480 lb.).

Where delivery was to be made in April or May, 1918, 76s. 9d. per qr. of 504 lb. (73s. 1d. per 480 lb.).

Where delivery was to be made on or after 1st June, 1918, 77s. 9d. per qr. of 504 lb. (74s. 1d. per 480 lb.).

On 31st August, 1918, the following maximum prices were fixed for wheat harvested in 1918 :—

Where sale was made before 1st January, 1919, 75s. 6d. per qr. of 504 lb. (71s. 11d. per 480 lb.).

Where sale was made in January, February, or March, 1919, 76s. per qr. of 504 lb. (72s. 5d. per 480 lb.).

Where sale was made on or after 1st April, 1919, 76s. 6d. per qr. of 504 lb. (72s. 10d. per 480 lb.).

There was no maximum price for wheat harvested in 1919, but millers were informed by the Food Controller that the prices to be paid by them should not exceed an average of 76s. 6d. per qr. of 504 lb. (72s. 10d. per 480 lb.) for wheat purchased on rail at producer's station, or 77s. per qr. of 504 lb. (73s. 4d. per 480 lb.) for wheat delivered into mill. (14th June, 1920.)

Prices of Wheat and Oats.—In reply to a question by Major Barnes, the Parliamentary Secretary to the Ministry stated that the relative prices of wheat and oats in 1913 and in 1919 were as follows :—

	WHEAT.		OATS.			
	Price per Imperial Qr. of British Wheat.	Quantity produced in United Kingdom.	Imports (including flour in equivalent wt. of grain).	Price per Imperial Qr. of British Oats.	Quantity produced in United Kingdom.	Imports.
	<i>s. d.</i>	<i>qr.</i>	<i>qr.</i>	<i>s. d.</i>	<i>qr.</i>	<i>qr.</i>
1913	31 8	7,087,000	28,587,000	19 1	20,660,000	6,520,000
1919	72 11	8,665,000	22,401,000	52 5	25,495,000	2,409,000

(7th June, 1920.)

Councils of Agriculture.—In reply to a question by Sir K. Wood, the Parliamentary Secretary to the Ministry stated that the Councils of Agriculture would be established as soon as possible after the County Agricultural Committees, now being sent up by each County Council in England and Wales, had appointed their two representatives. It was hoped that this would be done at the first meeting of each Committee, but as in many instances the County Committee had not yet been fully constituted, it was impossible to say definitely when the Agricultural Councils would be formed. It was hoped, however, that the Councils would be constituted in time for the first meetings to be held next November. (9th June, 1920.)

Home Grown Sugar.—In reply to a question by Mr. C. White, the Parliamentary Secretary to the Ministry stated that the company known as Home Grown Sugar, Ltd., was registered on the 13th February, 1920, with a nominal capital of £1,000,000, divided into 1,000,000 ordinary shares of £1 each. The Government agreed to subscribe for a number of ordinary shares (not exceeding 250,000), equivalent to the number of allotted to public subscribers. The total number of shares issued by the company was 500,000, of which 250,000 had been allotted to the Government. No shares had been allotted otherwise than for cash. The Government had guaranteed a dividend of 5 per cent. per annum upon the capital subscribed by the public up to 250,000 shares for the period ending 31st March, 1930. The directors might, at any time after repayment to the Minister of Agriculture of any sum paid to the company, call upon the Minister to sell his shares upon payment of their par value, together with a deferred dividend of 5 per cent. upon such shares as from the date of allotment.

The remuneration of the Directors, other than the Managing Directors, was at the rate of £300 per annum for each Director, and an additional sum of £100 per annum was paid to the Chairman for the time being of the Board of Directors. The Government had no voice in the appointment of Members of Parliament as Directors. The Minister of Agriculture was, however, entitled to appoint a Director of the Company to act as the Government's financial representative, and such financial

representative had been appointed. The Directors' fees are paid by the Company, but the fees of the financial representative were paid over to the Ministry, and the financial representative was paid an equivalent amount by the Ministry in place of receiving his remuneration direct from the Company. (8th June, 1920.)

Calf Breeding.—In reply to a question by Captain Terrell, the Parliamentary Secretary to the Ministry stated that while the Ministry was not taking any special steps to stimulate the raising of calves, the provision of bulls under the Live Stock Scheme encourages indirectly the rearing of calves, as on the information before the Ministry practically all the heifer calves and the majority of the bull calves that were bred from subsidised sires were reared in consequence of their higher value. It was to be regretted that large numbers of calves bred in dairying districts were not fit to rear owing to the fact that many dairy farmers made use of badly-bred bulls. It was hoped that when meat was de-controlled next month* there would be greater inducement to rear calves. (16th June, 1920.)

The King's Premium for Stallions.—In reply to a question by Sir R. Newman, the Parliamentary Secretary to the Ministry stated that of the 60 stallions which were awarded King's Premiums this season, 53 had been raced and 36 of them were winners. In their award of premiums the judges take into consideration a stallion's turf record, and with this object in view they were furnished by the Ministry with particulars of the racing performances of all the horses exhibited for premiums. (7th June, 1920.)

The Agriculture Bill and Nursery Gardens.—In reply to a question by Mr. A. Samuel, the Parliamentary Secretary to the Ministry stated that although the occupiers of nursery grounds had to pay their employees the minimum wages prescribed by the Agricultural Wages Board, nursery grounds did not come within the definition of a holding in the Agricultural Holdings Act, and consequently the occupiers could not obtain the compensation provided by the Act for tenants of agricultural holdings or market gardens. It appeared to the Ministry that it would be difficult to justify the extension of the scope of the Agricultural Holdings Act so as to include nursery grounds, and he was not prepared, therefore, to propose an Amendment to the Agricultural Bill to that effect. With regard to the point as to the payment of minimum wages, it seemed obvious that occupiers of nursery grounds could not reasonably expect to pay wages which are less than minimum wages fixed for agricultural labourers. (16th June, 1920.)

Hay and Straw Department, War Office.—In reply to a question by Sir A. Williamson, the Parliamentary Secretary to the Ministry stated that the Forage Department of the War Office was being wound up, and would cease to exist at the end of the present month. The Department occupied one office only with a small staff, which was daily diminishing. (9th June, 1920.)

Agricultural Organisation Society.—In reply to a question by Mr. Robert Young, the Parliamentary Secretary to the Ministry stated that during the financial year 1919-20, grants paid to the Agricultural Organisation Society from the Development Fund and the Ministry amounted to £45,600. In addition, a loan of £15,000 was issued to the

* Control of Meat ceased on 4th July, 1920; see note on p. 309.

Society from the Development Fund. The organising was done by paid organisers, but a large amount of voluntary assistance was also given. The salaries and expenses of the staff amounted to £27,810, and £9,462, respectively; of these amounts approximately four-fifths were met by the Government grants. The amount of affiliation fees paid during the year was £6,990. The number of societies which paid fees was 1,074. (9th June, 1920.)

Agricultural Societies.*—In reply to a question by Mr. R. Young, the Parliamentary Secretary to the Ministry stated that he had no precise information as to the membership of the *National Union of Allotment Holders*. The General Secretary of the Union had, however, furnished him with the following statement:

"The Federations, Associations and Societies affiliated to the National Union direct and through such bodies as the Vacant Land Cultivation Society and the London, Southern, Yorkshire, Welsh, North-Eastern, North-Western, Midland and South-Western Sections, represent a membership of 250,000."

"The number of single societies or groups, and societies which come via sections and federations was, 1,050. This number represents an advance of roughly 450 societies since last year. Included are federations and societies which have formally decided to affiliate, and which do not pay fees for some little time yet. Everyone affiliated through a federation, association, or society pays a fee. Our year commenced three months ago, and the various affiliated bodies are now collecting their members' contributions."

With regard to the *Agricultural Organisation Society*, he stated that the number and membership of the societies which had paid affiliation fees to the *Agricultural Organisation Society* for the year ending 31st March, 1920, was as follows:—

			<i>Farmers'</i> <i>Societies.</i>		<i>Allotment and</i> <i>Small-Holding</i> <i>Societies.</i>
Number	..	..	290	....	784
Membership	..	..	65,500	....	101,000

These figures did not include the whole of the societies affiliated to the *Agricultural Organisation Society*, inasmuch as there were a number which, for one reason or another, were in arrears with the payment of affiliation fees. They were now being pressed to pay up their arrears on penalty of dis-affiliation. If these societies were included and account taken of the fact that the affiliation fees for 1919-20 were based on membership as disclosed by the Annual Return for 31st December, 1918, the total membership of societies affiliated to the *Agricultural Organisation Society* would be raised to approximately 90,000 farmers and 150,000 allotment holders.

For some time the Ministry had been endeavouring to make arrangements which would prevent any possibility of overlapping between the work of these two bodies. In the course of the negotiations, the *National Union* suggested that the Allotment Sections of the *Agricultural Organisation Society* and the *National Union* should both be wound up, and that a new body representative of all classes of allotment holders should be established. This proposal was carefully considered, but the

* This question was omitted from last month's issue owing to pressure of space.

Minister was unable to adopt it as, in his opinion, it would not be in the best interests of the allotment movement to organise allotment holders entirely apart from all other persons interested in the production of food.

The Ministry submitted, as an alternative, suggestions for delimiting the functions of each body, the principle of which was that, while each association would preserve its present independence, its work for the allotment holder would be complementary to that undertaken by the other association and by the Ministry itself. This proposal, however, had not met with the approval of the National Union, and had, therefore, been abandoned for the present. (11th May, 1920.)

Prices of Sulphate of Ammonia, 1920-21.—The Ministry of Agriculture and Fisheries has come to an agreement with the great majority of the makers of sulphate of ammonia with regard to the maximum prices to be charged for this fertiliser for home agricultural use for delivery in the season 1920-21.

These prices are appreciably higher than those ruling during last season owing to the substantial increases which have occurred since last year in the cost of coal, wages and raw materials. The Ministry considers that these prices are not more than are necessary to secure to the manufacturers a reasonable trade profit.

For sale in lots of not less than 4 tons for delivery by rail or water to purchasers' nearest railway station or wharf in Great Britain, less a trade discount to manure mixers, agricultural merchants, dealers and co-operative societies, the prices are:—

Month of Delivery.	Price per Ton in Bags net Cash.		
	£	s.	d.
July, 1920	23	10	0
August	24	0	0
September	24	10	0
October	25	0	0
November	25	10	0
December	26	0	0
January, 1921	26	10	0
February	27	0	0
March, April and May	27	10	0

In the case of deliveries to Ireland, Isle of Man, or Channel Islands the above prices include delivery f.o.b. port in Great Britain.

Farmers should place their orders without delay with their usual dealer or co-operative society.

Manure mixers, merchants, dealers and co-operative societies should send their orders to the British Sulphate of Ammonia Federation, Ltd., 30, Grosvenor Gardens, London, S.W. 1.

These prices are for sulphate of ammonia containing 20½ per cent. by weight of ammonia. On deliveries of quantities of 2 cwt. or over there are special allowances and extra charges for different analyses, for grinding, for freedom from acid, etc.

The above increases or reductions in the agreed maximum prices chargeable shall not apply to any delivery of less than 2 cwt. of sulphate of ammonia.

For deliveries of less than 4 tons, or for sales of small quantities made *ex* merchant's store, the following additions may be made to the price charged for 4-ton lots :—

<i>Quantity delivered.</i>		<i>Additional Price.</i>	
2 tons and over but less than 4 tons	..	5 0	per ton.
1 ton	..	10 0	..
2 cwt.	..	1 0	per cwt.
1 "	..	2 0	..
28 lb.	..	3 0	..
14 "	..	4 0	..

In the case of sales for delivery to consumer's premises *ex* merchant's shop or store, the cost of conveyance, charged at local rates, may be added.

Other conditions attaching to the sale of sulphate of ammonia are given in a Circular (F.P. 506/Sr) issued by the Ministry. Copies may be obtained post free on application.

Farmers should experience no difficulty in obtaining prompt delivery of sulphate of ammonia at the above prices. If any such difficulty should arise, the Ministry will be able to arrange for supplies on receiving full particulars, addressed to the Director-General, Ministry of Agriculture and Fisheries, 72, Victoria Street, London, S.W. 1.

Weather Forecasts for Farmers.—The Meteorological Office will, as in past years, supply forecasts of weather by telegraph to persons desirous of receiving them, upon payment of a registration fee of 1s. and the cost of the telegrams, computed at 1s. per message.

The forecasts are drawn up at 10.30 a.m., 4.0 p.m., and 9.0 p.m. (summer time). Forecasts issued at the morning hour refer to the period covering the afternoon of the day of issue and the morning of the following day. Those issued in the afternoon and evening refer to the whole of the following day. All the forecasts include a Further Outlook of the probable weather beyond the 24-hour period whenever such a Further Outlook can be given.

Notifications will also be issued by telegram when conditions indicate that a spell of several days fair weather is likely, and again when the spell is about to break up. For this service a fee of 6d. is charged for telegraphy. A minimum deposit of 5s. against which the charges may be booked is required.

Applications for regular forecasts (as distinct from Spell of Notifications) should specify the hour of the forecasts desired (or hours if more than one telegram daily is required). They should be sent to the Director, Meteorological Office, Air Ministry, London, W.C.2, and should be accompanied by a cheque or postal order payable to the Meteorological Committee to cover the cost of the telegrams for the period during which the forecasts are to be sent.

Further particulars and printed forms of application may be obtained from the Director of the Meteorological Office.

Applications by telegraph for single forecasts shall be addressed to "Weather, London," and the reply should be prepaid.

Regulations for Importation of Hay and Straw.—The Ministry desires to draw attention to the Orders which prohibit the importation of hay and straw from certain countries.

The only countries from which hay and straw may be imported into Great Britain are: The United States of America, the Dominions of

Canada, Australia and New Zealand, the Union of South Africa, Norway, the Channel Islands and the Isle of Man.

Certain exceptions are made in the case of hay and straw in which imported merchandise is packed; manufactured straw not intended for use as fodder or litter for animals; and hay and straw authorised to be landed by special licence of the Ministry for use otherwise than as fodder or litter for animals.

Appointment of Controller of Horticulture.—The Minister of Agriculture, Lord Lee of Fareham, has appointed Mr. W. J. Lobjoit, O.B.E., F.R.H.S., to be Controller of Horticulture (unpaid) at the Headquarters of the Ministry.

Mr. Lobjoit is President-Elect of the Chamber of Horticulture, Chairman of the Agricultural Committee, the Small Holdings Committee, and the Agricultural Education Committee of the Middlesex County Council, of which he is also an Alderman; Chairman of the Market Gardening, Fruit-growing and Hop Committee of the Central Chamber of Agriculture; Examiner to the Royal Horticultural Society; and Member of the Horticultural Advisory Committee of the Ministry of Agriculture. Mr. Lobjoit is also a well-known writer on horticultural subjects, and has a lifelong practical experience of market gardening on a large scale.

Fruit Crop Prospects on 1st July.—It was stated in a notice issued by the Ministry on 3rd July that, so far as can be seen, the prospects relating to bush fruit appear to be generally good. Certainly gooseberries have yielded remarkably well, and raspberries are carrying heavy crops. The strawberry crop, owing to early drought, is much lighter than was anticipated at the beginning and will yield only fairly. The black currant crop is very much on the light side. The top fruit crops are very uneven throughout the country. While one orchard appears to be giving fair crops the next one is almost a total failure. Of plums, Monarch appears to have done well, giving in some cases heavy yields; Pershore are but a fair crop, and in Evesham growers expect to get about ½ crop; cherries are decidedly thin and it is doubtful if many growers will clear expenses. Apples generally are scarce, though some of the early cooking varieties are bearing a medium crop this season, and even isolated patches of Worcesters are to be found. In the Norfolk fruit area, which is but a small though an increasing fruit district, the apple crop is good. Nuts, of which the Kentish Cob is probably the most famous, have not been abundantly produced this year, and something less than half a crop is anticipated.

The statistics received by the Ministry relating to plums appear to show that Victorias are producing only about 10 per cent., Pershores 80 per cent., Tzars 15 per cent., Damsons 33 per cent., of the crop produced in 1919, while Monarch is giving about 15 per cent. more than in 1919.

Alteration in the Date of Publication of this Journal.—Commencing with the September issue, this *Journal* will be published on the 1st of the month, instead of on the 15th, as heretofore. The August issue will be issued about the 7th August.

ADDITIONS TO THE LIBRARY.

Agriculture, General and Miscellaneous—

- Rhode Island Agricultural Experiment Station.*—Bull. 180 :—A Field Comparison of Hydrated Lime with Limestone of Different Degrees of Fineness. (18 pp.) Kingston, R.I., 1919. [63.15.]
- University College of North Wales, Department of Agriculture.*—Formation of Pastures. (11 pp.) Bangor, 1920. [63.33(a).]
- U.S. Department of Agriculture.*—Circ. 84 :—Crop Injury by Borax in Fertilisers. (35 pp.) Washington, 1920. 10 cts. [63.168.]
- University College of N. Wales, Department of Agriculture.*—Reports on Experiments, 1917 to 1919. (51 pp.) Bangor, 1920. [63.06.]

Field Crops—

- Kentucky Agricultural Experiment Station.*—Bull. 221 :—Marketing Hemp (19 pp.) Lexington, 1919. [63.34112.]
- California Agricultural Experiment Station.*—Bull. 309 :—The Carob in California. Nutritive Value of the Carob Bean. (22 pp.) Berkeley, 1919. [63.342.]
- Bradbury, F.*—Flax Culture and Preparation. A Complete Description of the Process from Selection of Seed to Preparation for the Market. (154 pp.) London: Sir Isaac Pitman & Sons, 1920. 9s. net, [63.34111.]
- Amos, A.*—Ensilage. (42 pp.) [Jour. of Farmers' Club, 1920, Part 2.] 6d. [63.1985.]

Horticulture—

- Kentucky Agricultural Experiment Station.*—Bull. 216 :—Strawberries. (28 pp.) Lexington, 1918. [63.41(c).]
- Kentucky Agricultural Experiment Station.*—Bull. 218 :—Some Experiments with Tomatoes. (11 pp.) Lexington, 1918. [63.513.]
- California Agricultural Experiment Station.*—Bull. 310 :—Plum Pollination. (28 pp.) Berkeley, 1919. [63.41(08); 63.41(b).]
- Tennessee Agricultural Experiment Station.*—Bull. 121 :—Pruning and Spraying the Home Orchard and Vineyard. (47 pp.) Knoxville, 1918. [63.41-195; 63.294.]

Plant Diseases—

- Canada, Department of Agriculture.*—Crop Protection Leaflet 12 :—The Beet Webworm. (*Loxostege sticticalis*, L.) (3 pp.) Ottawa, n.d. [63.27.]
- Kentucky Agricultural Experiment Station.*—Bull. 213 :—Observations and Experiments on the Bean and Pea Weevils in Kentucky. (27 pp.) Lexington, 1917. [63.27-32.]
- Illinois Agricultural Experiment Station.*—Bull. 217 :—An Apple Canker due to *Cytospora*. (15 pp.) Urbana, 1919. [63.24.]
- Illinois Agricultural Experiment Station.*—Bull. 220 :—Black Spot of Onion Sets. Caused by *Volvetella circinans*. (26 pp.) Urbana, 1919. [63.24.]
- U.S. Department of Agriculture.*—Bull. 808 :—Studies on the Life History and Habits of the Jointworm Flies of the Genus *Harmolita* (*Isosoma*), with Recommendations for Control. (27 pp.) Washington, 1920. 5 cts. [63.27; 63.27-31.]
- U.S. Department of Agriculture.*—Farmers' Bull. 1061 :—Haricquin Cabbage Bug (*Murgantia histrionica*, Hahn), and its Control. (16 pp.) Washington, 1920. [63.27.]

Live Stock—

- Indermuhle, K.*—Rindvichzucht. Herausgegeben vom Verbande der Lehrer an landwirtschaftlichen Schulen der Schweiz. (85 pp.) Frauenfeld, Huber & Co., 1920. [63.62(02).]
- Heiderich, Dr. F. (Edt.).*—Die Viehzucht im österreich-ungarn. (248 p.p.) Wien, Handels, Museum, 1919. [63.6(436).]

- Faber, H.*—Forage Crops in Denmark. The Feeding Value of Roots, Selected Strains of Roots and Grasses, Guarantees in the Trade in Seeds. (100 pp.) London: Longmans Green, 1920. 6s. [63.33(02).]
Maine Agricultural Experiment Station.—Bull. 272:—Inheritance Studies of Certain Colour and Horn Characteristics in First Generation Crosses of Dairy and Beef Breeds. (20 pp.) Orono, 1918. [575.1; 63.62(04).]

Dairying and Food, General—

- Ontario Department of Agriculture.*—Dairy Branch Circ. 20:—Cool Sweet Milk Makes Most and Best Cheese. (4 pp.) Toronto, 1919. [63.717.]
Ontario Department of Agriculture.—Dairy Branch Circ. 21:—Keep Cream Cold and Sweet. (4 pp.) Toronto, 1919. [63.717.]
Ontario Department of Agriculture.—Dairy Branch Circ. 22:—Why Should the Milk of the Individual Cow be Weighed and Tested, and Records kept of the Results? (4 pp.) Toronto, 1919. [543.2.]
Ontario Department of Agriculture.—Dairy Branch Circ. 26:—Ice on the Farm. (2 pp.) Toronto, 1920. [664.8.]
Kentucky Agricultural Experiment Station.—Bull. 217:—Profitable Dairy. Farm Organization in Kentucky. (50 pp.) Lexington, 1918. [63.7(72); 63.714.]
U.S. Department of Agriculture.—Farmer's Bull. 1078:—Harvesting and Storing Ice on the Farm. (31 pp.) Washington, 1920. [664.8.]

Veterinary Science—

- Kentucky Agricultural Experiment Station.*—Bull. 207:—Studies in Forage Poisoning, V.: A Preliminary Report on an Anaerobic Bacillus of Etiologic Significance. (65 pp.) Lexington, 1917. [619(04).]
U.S. Department of Agriculture.—Circ. 82:—A New Sheep-Poisoning Plant (*Daubentonia longifolia*) of the Southern States. (4 pp.) Washington, 1920. [63.255.]

Birds, Poultry and Bees—

- Kentucky Agricultural Experiment Station.*—Bull. 220:—The Effect of Certain Grain Rations on the Growth of the White-Leghorn Chick, and their Influence on Subsequent Egg-production. (20 pp.) Lexington, 1919. [63.6515.]
U.S. Department of Agriculture.—Circ. 79:—Tropical Fowl Mite in the United States, with Notes on Life History and Control. (8 pp.) Washington, 1920. 5 cents. [59.169.]
U.S. Department of Agriculture.—Circ. 76:—Directions for Collecting Flowering Plants and Ferns. (8 pp.) Washington, 1920. 5 cents. [579.]
U.S. Department of Agriculture.—Bull. 804:—A Study of the Behaviour of Bees in Colonies Affected by European Foul-Brood. (27 pp.) Washington, 1920. 5 cents. [63.81(04).]

Engineering—

- U.S. Department of Agriculture.*—Circ. 149:—Proposed Farm Power Studies, as outlined by the Farm Power Conference and the Departmental Committee on Farm Power Projects. (8 pp.) Washington, 1920. [63.17(04).]

Economics—

- Australia Commonwealth.*—Census of the Commonwealth, taken for the Night between the 2nd and 3rd April, 1911. Vol. I. Statistician's Report including Appendices. (480 pp.) Melbourne, 1917. [312(9).]
Rogers, J. E. T.—Six Centuries of Work and Wages. The History of English Labour. (591 pp.) London: Swan, Sonnenschein & Co., 1891. 10s. 6d. [337.]
Weaver, Sir L.—Village Clubs and Halls. (112 pp.) London: Offices of "Country Life," 1920. 7s. 6d. net. [36.]
Select Committee on Land Values.—Report of the Committee, together with Proceedings, Minutes of Evidence and Appendices. (96 pp.) London: H.M. Stationery Office, [Cmd. 556], 1920. 1s. 6d. net. [336.22.]

SELECTED CONTENTS OF PERIODICALS.

Agriculture, General and Miscellaneous—

- Potassium-Bearing Minerals as a Source of Potassium for Plant Growth, *E. de Turk*. (Soil Science, October, 1919.) [63.1673.]
- Plant Ashes as a Source of Potash. (Bull. Imp. Inst., July–September, 1919.) [63.1673.]
- Notes on Agriculture in Cyprus and its Products, *W. Bevan*. (Bull. Imp. Inst., July–September, 1919.) [63(5).]
- Pflanzenanalyse und Düngerbedürfnis des Bodens, *Dr. Munter*. (Jour. f. Landwirtschaft, Band 67, Heft 4.) [63.161.]
- Die Bedeutung der Geologie für die land und forstwirtschaftliche Bodenkunde, *H. Niklas*. (Natur. Zeit. Land. und Forst, January–February, 1920.) [55.]
- Wie soll der Land- und Forstwirt geologische Karten lesen? *M. Schuster*. (Natur. Zeit. Land. und Forst, January–February, 1920.) [63.111.]
- The Use of Potash Salts, *J. Hughes*. (Jour. Bath & W. Agric. Soc., Vol. XIV., 1919–20.) [63.1673.]

Field Crops—

- Zur Frage des Anbaues und der Akklimatisation der Soja in Deutschland, (Natur. Zeit. Land. und Forst., January–February, 1920.) [63.321.]
- Sugar Beet Culture, *S. L. Bastin*. (Jour. Bath and W. Agric. Soc., Vol. XIV., 1919–20.) [63.3432.]

Live Stock—

- Government Goat Farm [U.S.A.]. (Breeder's Gazette, 4th December, 1919.) [33.638.]
- Fütterungsversuch mit aufgeschlossenem Stroh (Kochstroh, Kraftstroh). (Milch Zentralblatt, 15th February, 1920.) [63.604(a).]
- The Ideal Estate Pig—The Gloucester Old Spot, *A. Nicholson*. (Jour. Land Agents' Soc., April, 1920.) [63.64.]
- Scottish Pure Bred Live Stock (Mil.) Galloway Cattle, *F. N. M. Gourlay*. (Scott. Jour. Agric., April, 1920.) [63.62.]
- The Improvement of Live Stock in Relation to the Size of the Farm, *J. Long*. (Jour. Bath & W. Agric. Soc., Vol. XIV., 1919–20.) [63.6(42).]

Dairying and Food, General—

- Some Effects of the War on the Dairying Industry, *Primrose McConnell*. (Jour. Br. D. Farmers' Assoc., 1920.) [63.7(42).]
- Dairy Farming in Switzerland, *J. Long*. (Jour. Br. D. Farmers' Assoc., 1920.) [63.7(494).]

Birds, Poultry and Bees—

- Pixell-Goodrich, H. L. M.*—Determination of Age in Honey-Bees. (16pp.) [Quar. Jour. of Microscopical Science, Vol. 64, Part 2, January, 1920.] [63.81(04).]
- The Importance of the Poultry Industry to Ireland, *L. Murphy*. (Jour. Dept. Agric. and Tech. Instr. for Ireland, Vol. XX., No. 2.) [63.65(413).]

Forestry—

- Forest Policy, *R. L. Robinson*. (Quar. Jour. of Forestry, April, 1920.) [63.49(04).]

Economics—

- Ausführungsbestimmungen zum Reichssiedlungs-gesetz vom 11 August, 1919. (Zeit. des deut. Landwirtschaftsrats, Dezember, 1919.) [333.38(43).]
- The Village Clubs Association. (Jour. Land Agents' Soc., April, 1920.) [36.]
- Notes on Agricultural Costings, *J. Allison*. (Jour. Bath and W. Soc., Vol. XIV., 1919–20.) [338.58; 657.]
- Profit-Sharing in Agriculture, *Lord R. Cecil*. (Jour. Br. D. Farmers' Assoc., 1920.) [331.]

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